



Appendix 9.6 "*Fossilium Catalogus Palynomorphae*"  
within the context of the dissertation  
"Climate and vegetation dynamics during Marine Isotope Stage 19  
in Tenaghi Philippon (Northeastern Greece)"

**Tobias Fischer**

**Palynomorph classification  
based on MIS 20–18 samples (128–117 m depth)  
from Tenaghi Philippon (Drama Basin, NE Greece)**







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The classification of taxa and their palynologic information refers to Beug (2004), if not mentioned different.





# Dyadeae

## *Scheuchzeria palustris*



TP-2009 121.00 m

### General remarks

<b>Plant family</b>	Scheuchzeriaceae
<b>Common names (English/German)</b>	Rannoch-rush, pod grass Blumenbinse, Blasenbinse
<b>Palynomorph group</b>	<a href="#">Aquatic</a>
<b>Growth form</b>	Herbaceous perennials

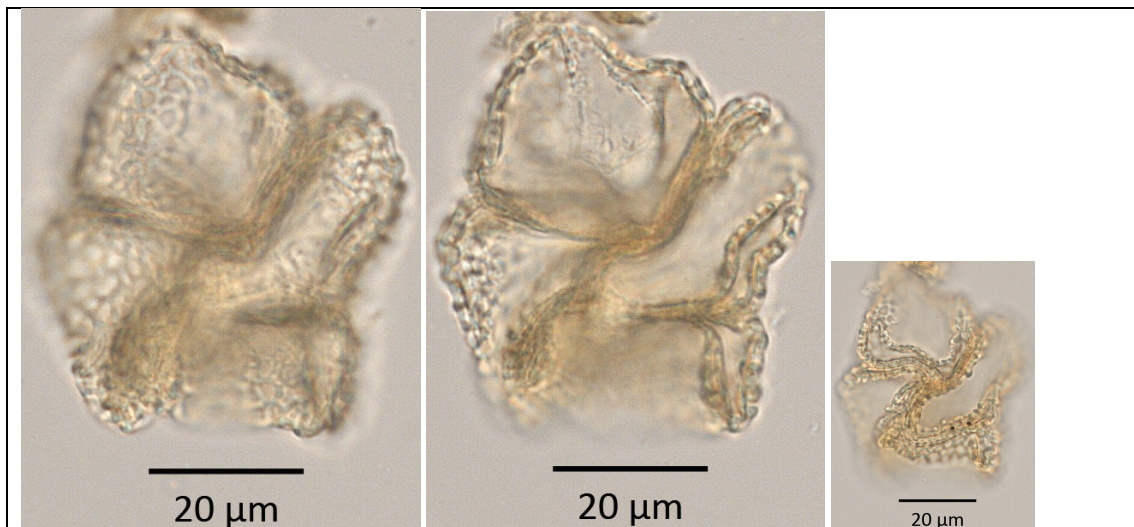
### Characteristics

<b>Pollen class</b>	Dyad, single pollen grains inaperturate
<b>Pollen grain shape</b>	Dyad, single pollen grains sphaeroid
<b>Pollen grain size</b>	36.3-50.0 µm
<b>Aperture</b>	Inaperturate
<b>Sculpture</b>	Reticulate, brochi 1.0-2.5 µm, muri small and often interrupted
<b>Sporoderm</b>	Exine 1.2-1.5 µm Endexine thin Columellae not visible
<b>Ecology</b>	Growing in peat bogs in boreal to temperate regions on N Hemisphere

# Tetradеае



## *Epipactis*



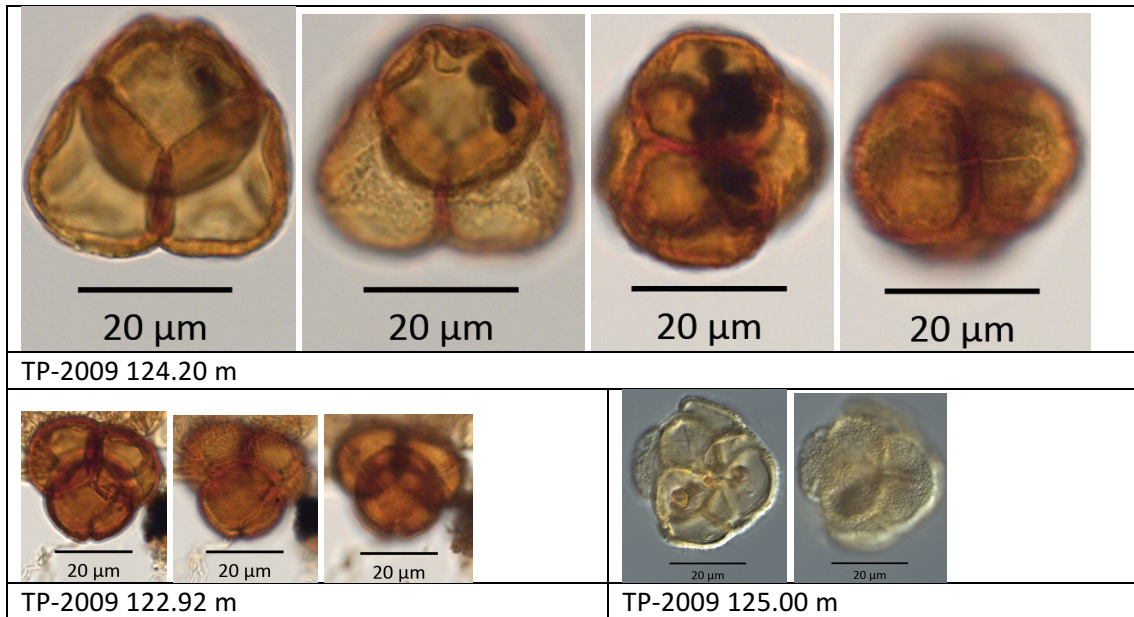
### General remarks

<b>Plant family</b>	Orchidaceae
<b>Common names (English/German)</b>	Helleborine Stendelwurz
<b>Palynomorph group</b>	Non-arboreal pollen
<b>Growth form</b>	Herbaceous perennials

### Characteristics

<b>Pollen class</b>	Tetrad, single pollen grains monoporate
<b>Pollen grain shape</b>	Tetrad
<b>Pollen grain size</b>	45.0-79.0 µm
<b>Aperture</b>	Pori 12-25 µm, mostly in distal position
<b>Sculpture</b>	Reticulate, brochi 1.0-5.5 µm, ± heterobrochate, muri 0.8-1.5 µm
<b>Sporoderm</b>	Exine 2.0-2.5(-3.0) µm, endexine thin Columellae distinct
<b>Ecology</b>	Grows in coniferous to deciduous forests up to alpine altitudes

## Ericaceae



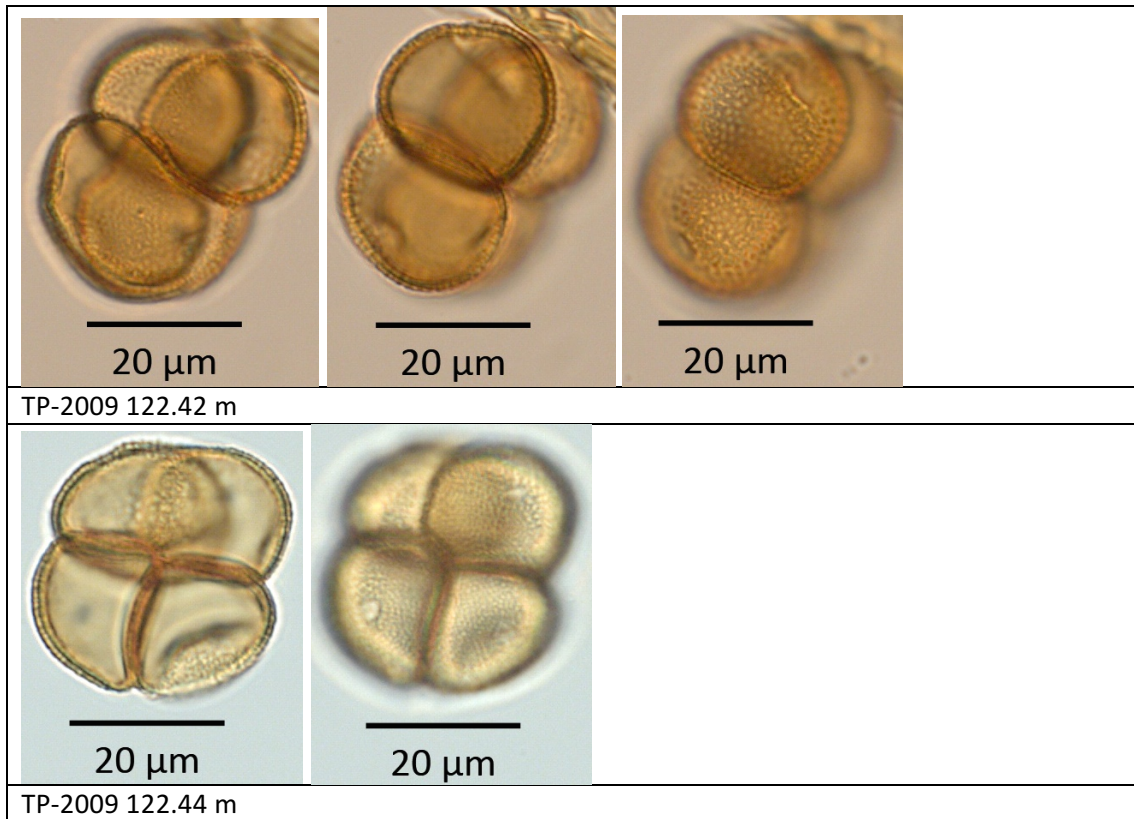
### General remarks

<b>Plant family</b>	Ericaceae
<b>Common names (English/German)</b>	Heath Heidekrautgewächse
<b>Palynomorph group</b>	Non-arboreal pollen
<b>Growth form</b>	Deciduous (± indeciduous) trees or shrubs

### Characteristics

<b>Pollen class</b>	Tetrad, single pollen grains tricolpate
<b>Pollen grain shape</b>	Tetrad
<b>Pollen grain size</b>	28.5-54.3 µm
<b>Aperture</b>	Colpi 11.3-24.8 µm
<b>Sculpture</b>	Scabrate, slightly verrucate
<b>Sporoderm</b>	
<b>Ecology</b>	Requires at least 4 months of mean temperatures above 10 °C, a rainy climate with >600 mm of annual precipitation and low continentality (Ozenda 1982, Polunin & Walters 1985, Loidi et al. 2007)

### *Typha latifolia* type



#### General remarks

<b>Plant family</b>	Typhaceae
<b>Common names (English/German)</b>	Bulrush Breitblättriger Rohrkolben
<b>Palynomorph group</b>	<a href="#">Aquatic</a>
<b>Growth form</b>	Herbaceous perennials

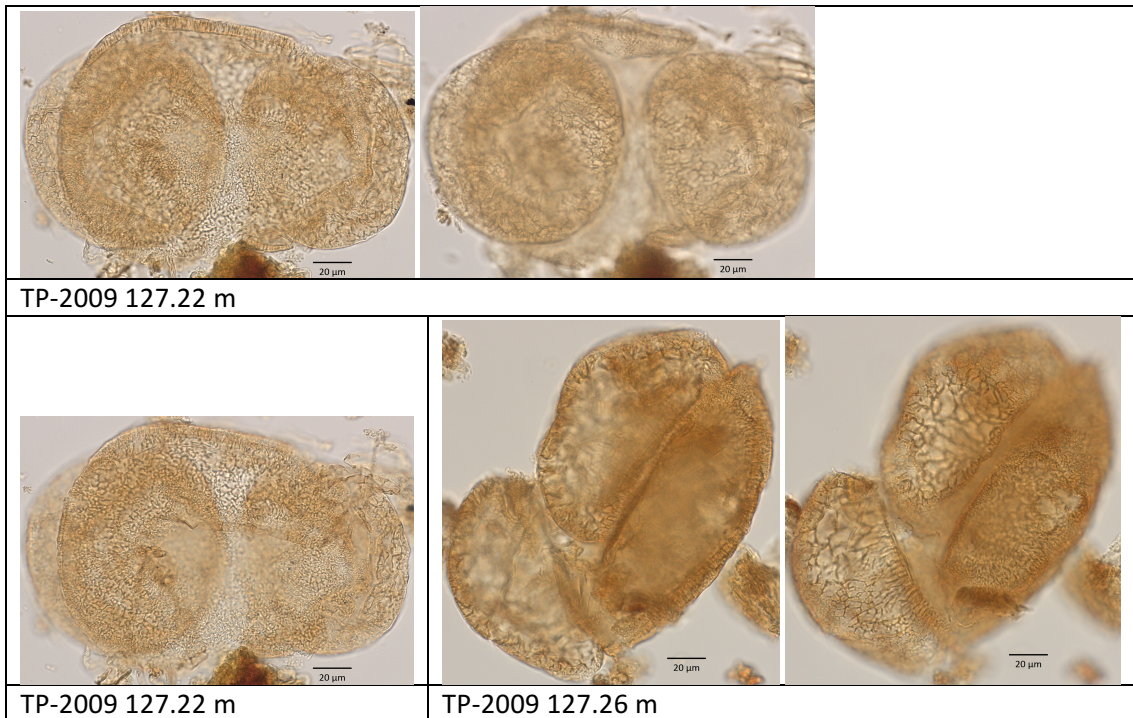
#### Characteristics

<b>Pollen class</b>	Tetrad, single pollen grains monoporate
<b>Pollen grain shape</b>	Tetrad, single pollen grains sphaeroid
<b>Pollen grain size</b>	35.7-62.8 µm
<b>Aperture</b>	Pori max. 6 µm
<b>Sculpture</b>	Reticulate, brochi 1-2 µm
<b>Sporoderm</b>	Exine 2 µm Endexine 1 µm Columellae distinct
<b>Ecology</b>	Indicates eutrophic conditions, prefers lower lake levels, but does not grow in swamps (van der Wiel & Wijmstra 1987, Hannon & Gaillard 1997)



# Vesiculatae

## Abies



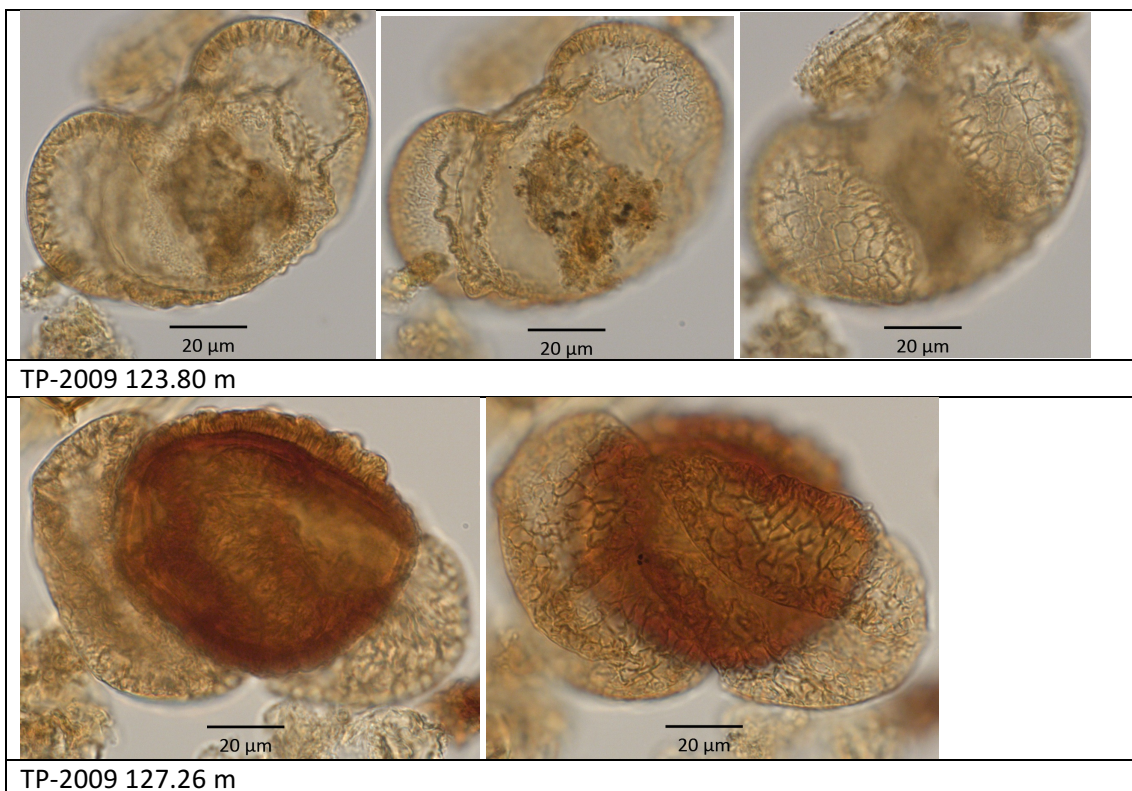
### General remarks

<b>Plant family</b>	Pinaceae
<b>Common names (English/German)</b>	Fir Tannen
<b>Palynomorph group</b>	Arboreal pollen
<b>Growth form</b>	Indeciduous tree

### Characteristics

<b>Pollen class</b>	Bisaccate
<b>Pollen grain shape</b>	Diploxytonoid Sacci more than semisphaeric, mostly three quarter circular
<b>Pollen grain size</b>	114.3-183.5 µm
<b>Aperture</b>	None
<b>Sculpture</b>	
<b>Sporoderm</b>	Corpus exine dorsal 6-10 µm, dorsal in center thin and external thick
<b>Ecology</b>	Tolerant to cold, but not to drought, requires higher moisture availability compared to <i>Pinus</i> (Christanis 1983, Prentice et al. 1992) Warmer and drier summers impede the expansion of <i>Fagus</i> and <i>Abies</i> , together with <i>Picea</i> most drought-sensitive trees, maybe also favoured by a decrease of late-frost events (Tinner & Lotter 2006)

## *Cedrus*



### General remarks

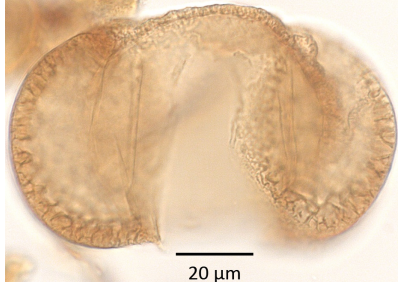
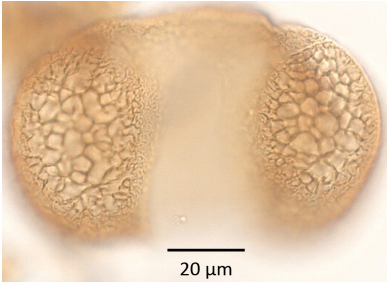

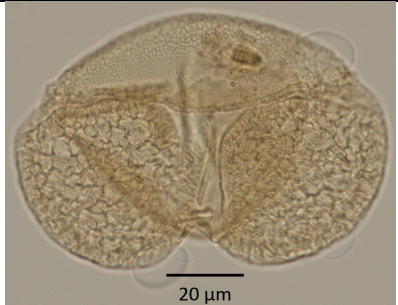
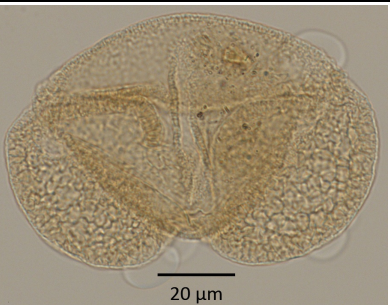

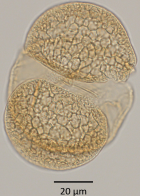


<b>Plant family</b>	Pinaceae
<b>Common names (English/German)</b>	Cedar Zedern
<b>Palynomorph group</b>	Arboreal pollen
<b>Growth form</b>	Indeciduous tree

### Characteristics

<b>Pollen class</b>	Bisaccate
<b>Pollen grain shape</b>	Haploxylonoid Sacci semipshaeric
<b>Pollen grain size</b>	75.2-107.0 µm
<b>Aperture</b>	None
<b>Sculpture</b>	
<b>Sporoderm</b>	Corpus exine dorsal 4-7 µm, in sacci transitioned (exine very thick in this part)



***Picea***

			
TP-2009 120.36 m		TP-2009 123.16 m	
			
TP-2009 121.08 m			
 		 	
TP-2009 127.91 m		TP-2009 121.97 m	

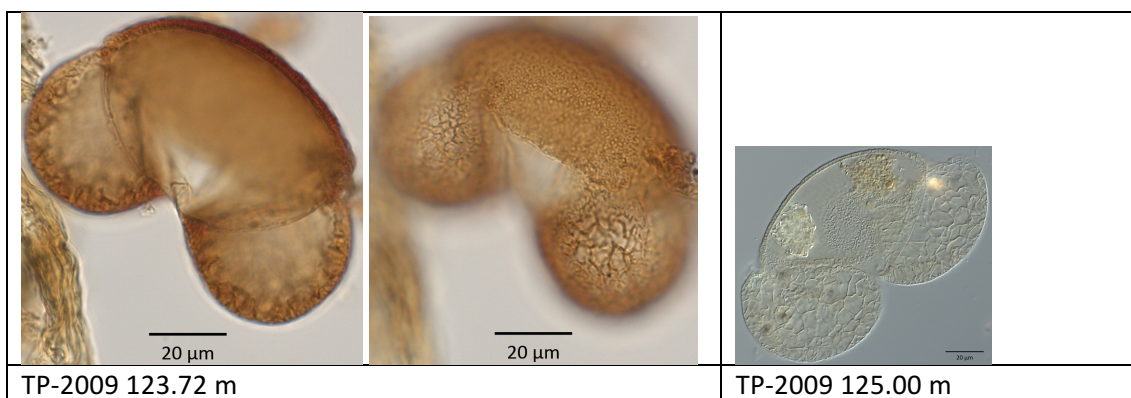
**General remarks**

<b>Plant family</b>	Pinaceae
<b>Common names (English/German)</b>	Spruce Fichten
<b>Palynomorph group</b>	Arboreal pollen
<b>Growth form</b>	Indeciduous tree

**Characteristics**

<b>Pollen class</b>	Bisaccate
<b>Pollen grain shape</b>	Haploxylonoid Sacci semispheric, 33.8-83.3 µm, meshes of netting max. 2 µm
<b>Pollen grain size</b>	78.0-157.2 µm
<b>Aperture</b>	None
<b>Sculpture</b>	
<b>Sporoderm</b>	Corpus exine 3-4.5 µm, exine in sacci transitioned
<b>Ecology</b>	Requires higher moisture availability compared to <i>Pinus</i> , drought-sensitive (Christanis 1983, Prentice et al. 1992, Tinner & Lotter 2006)

## *Pinus (Diploxylon)*



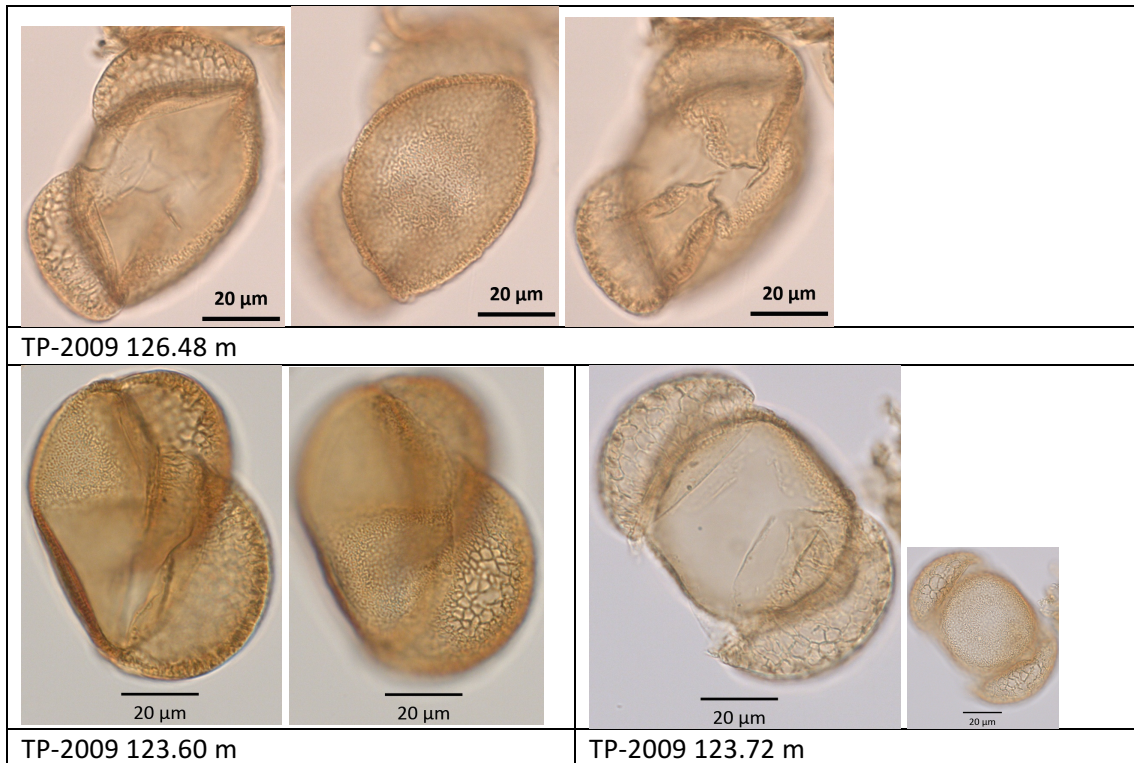
### General remarks

<b>Plant family</b>	Pinaceae
<b>Common names (English/German)</b>	Pine Kiefern, Föhren, Forlen
<b>Palynomorph group</b>	Arboreal pollen
<b>Growth form</b>	Indeciduous tree

### Characteristics

<b>Pollen class</b>	Bisaccate
<b>Pollen grain shape</b>	Diploxylonoid Corpus 41.2-66.2 µm Sacci more than semisphaeric, 33.5-72.5 µm
<b>Pollen grain size</b>	58.0-113.8 µm
<b>Aperture</b>	None
<b>Sculpture</b>	
<b>Sporoderm</b>	
<b>Ecology</b>	Tolerant to cold, but not to drought; pioneer plant, that grows nearly everywhere if the conditions are not too warm (Prentice et al. 1992, Tinner & Lotter 2006) Well adapted to growing on poor, sandy soils; therefore dominant arboreal taxon on exposed continental shelf (Kotthoff et al. 2008a) In marine cores: resistant against oxidation, transported to far off-shore distances (Kotthoff et al. 2008a)

## *Pinus (Haploxylon)*



### General remarks

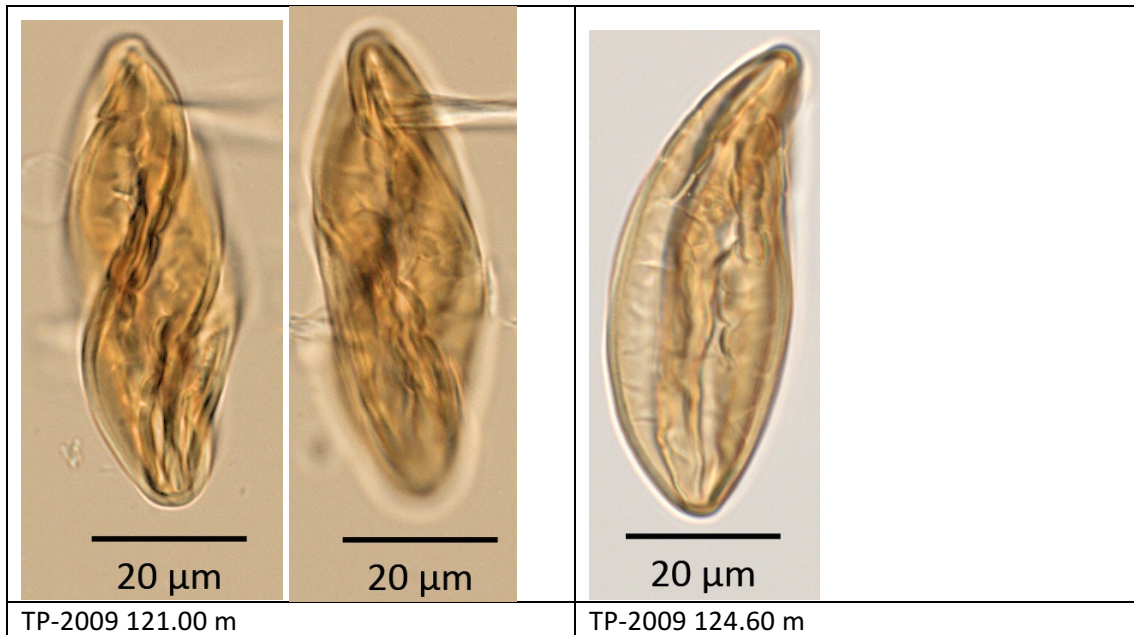
Plant family	Pinaceae
Common names (English/German)	Pine Kiefern, Föhren, Forlen
Palynomorph group	Arboreal pollen
Growth form	Indeciduous tree

### Characteristics

Pollen class	Bisaccate
Pollen grain shape	Haploxylonoid
Pollen grain size	71.8-101.7 µm ( <i>P. halepensis</i> )
Aperture	None
Sculpture	
Sporoderm	

# **Inaperturatae & Polyplicatae**

### *Ephedra distachya* type



#### General remarks

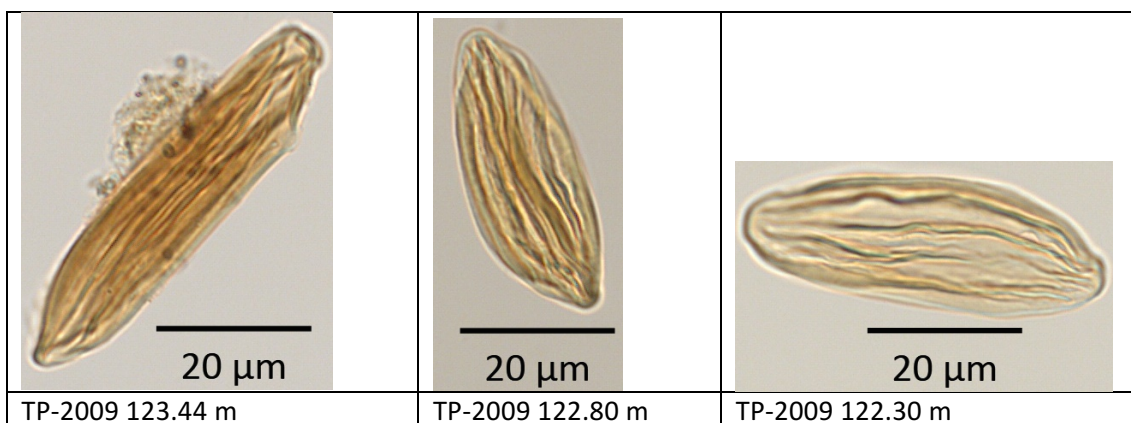
<b>Plant family</b>	Ephedraceae
<b>Common names (English/German)</b>	Gewöhnliches Meerträubel
<b>Palynomorph group</b>	Arboreal pollen
<b>Growth form</b>	Shrub

#### Characteristics

<b>Pollen class</b>	Inaperturate, polyplicate
<b>Pollen grain shape</b>	Prolate to perprolate
<b>Pollen grain size</b>	36.3-63.8 µm
<b>Aperture</b>	Zigzaggy and branched pseudocolpi between two ribs
<b>Sculpture</b>	3-8 longitudinal ribs
<b>Sporoderm</b>	
<b>Ecology</b>	Indicator for dry conditions (Sánchez Goñi et al. 2016, Tzedakis et al. 2004), resistant to drought stress and well adapted to grow in coastal areas (Kotthoff et al. 2008a, 2008b)



### *Ephedra fragilis* type




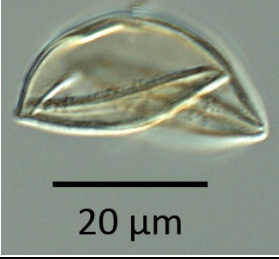
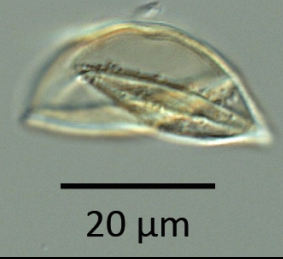


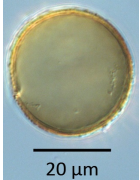

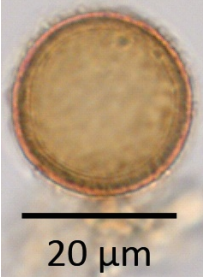
#### General remarks

Plant family	Ephedraceae
Common names (English/German)	Joint pine
Palynomorph group	Arboreal pollen
Growth form	Shrub

#### Characteristics

Pollen class	Inaperturate, polyplicate
Pollen grain shape	Prolate to perprolate
Pollen grain size	30.0-59.0 µm
Aperture	Straight and unbranched pseudocolpi between two ribs
Sculpture	(9-)13-17 longitudinal ribs
Sporoderm	
Ecology	Indicator for dry conditions (Sánchez Goñi et al. 2016, Tzedakis et al. 2004), resistant to drought stress and well adapted to grow in coastal areas (Kotthoff et al. 2008a, 2008b)

## Juniperus

											
TP-2009 124.50 m									TP-2009 125.00 m		
											
TP-2009 125.68 m			<i>J. phoenica</i> , TP-2009 122.56 m			<i>J. phoenica</i> , TP-2009 123.88 m					

### General remarks

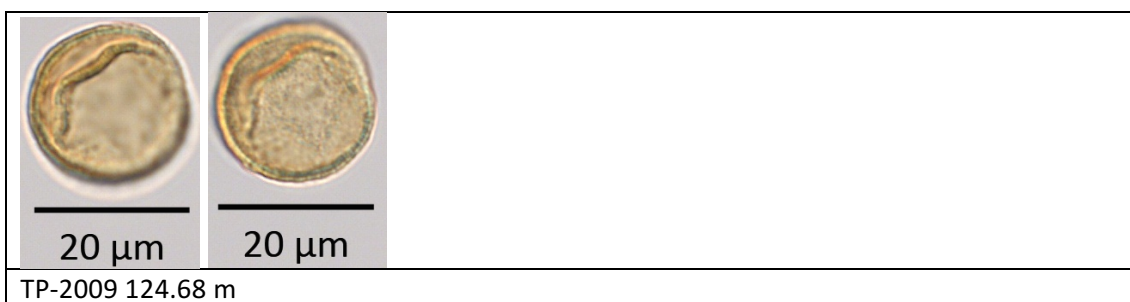
<b>Plant family</b>	Cupressaceae
<b>Common names (English/German)</b>	Juniper Wacholder
<b>Palynomorph group</b>	Arboreal pollen
<b>Growth form</b>	Indeciduous tree or shrub

### Characteristics

<b>Pollen class</b>	Inaperturate
<b>Pollen grain shape</b>	Normally sphaeroid-globose, but PG often splitted, than seemingly prolate
<b>Pollen grain size</b>	Non-splitted 25.2-43.8 µm
<b>Aperture</b>	None
<b>Sculpture</b>	Microgemmate/-clavate
<b>Sporoderm</b>	Sporoderm thin-walled
<b>Ecology</b>	Requires warm, but drier conditions (Christanis 1983) Due to greater mean canopy carbon dioxid uptake for <i>Juniperus</i> it is replacing <i>Quercus</i> in semiarid savannas → more drought tolerant (Owens 1996)



## *Populus*



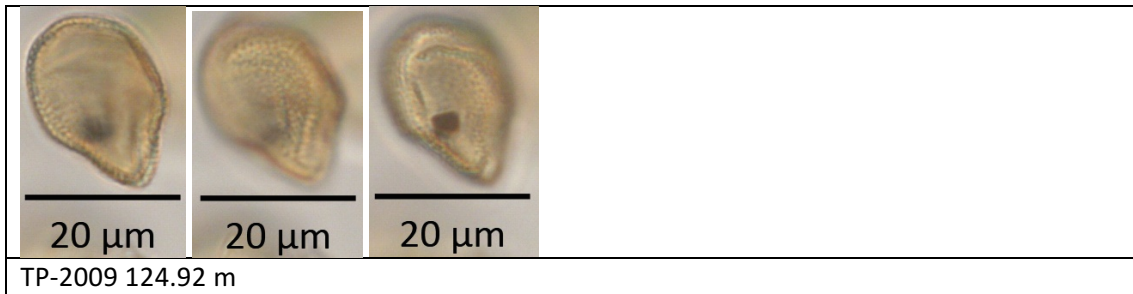
### General remarks

<b>Plant family</b>	Salicaceae
<b>Common names (English/German)</b>	Poplar Pappel
<b>Palynomorph group</b>	Arboreal pollen
<b>Growth form</b>	Deciduous tree or shrub

### Characteristics

<b>Pollen class</b>	Inaperturate
<b>Pollen grain shape</b>	Globose
<b>Pollen grain size</b>	15.8-37.8 µm
<b>Aperture</b>	None
<b>Sculpture</b>	Microechinate, -gemmate or –baculate, intectate
<b>Sporoderm</b>	Exine 0.7-1.0 µm

***Callitriche obtusangula***



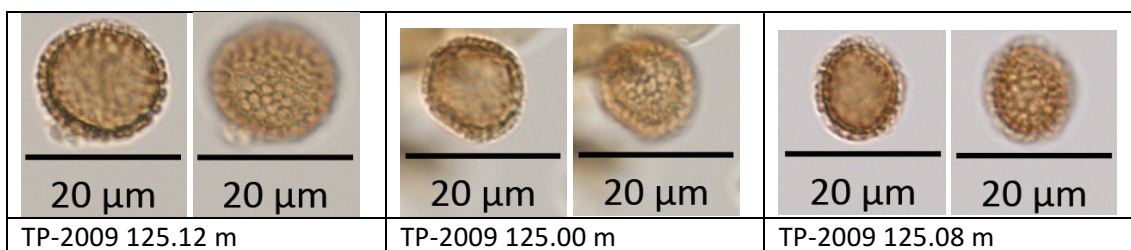
**General remarks**

<b>Plant family</b>	Plantaginaceae
<b>Common names (English/German)</b>	Blunt-fruited water starwort Nussfrüchtiger Wasserstern
<b>Palynomorph group</b>	<a href="#">Aquatic</a>
<b>Growth form</b>	Hydrophyte, herbaceous perennials

**Characteristics**

<b>Pollen class</b>	Inaperturate
<b>Pollen grain shape</b>	Distinct elliptic
<b>Pollen grain size</b>	19.2-36.8 µm
<b>Aperture</b>	None
<b>Sculpture</b>	Slightly reticulate, brochi 1 µm
<b>Sporoderm</b>	
<b>Ecology</b>	High abundances indicate water depth ca. 0.1-2 m (Harrison & Digerfeldt 1990)

### *Callitriche stagnalis*





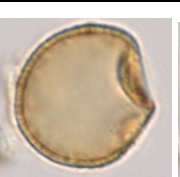


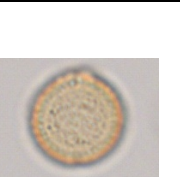
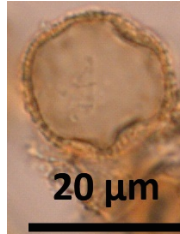
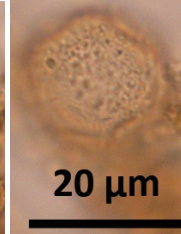
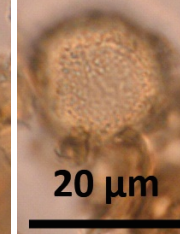
#### General remarks

<b>Plant family</b>	Plantaginaceae
<b>Common names (English/German)</b>	Pond water starwort Teich-Wasserstern
<b>Palynomorph group</b>	<a href="#">Aquatic</a>
<b>Growth form</b>	Hydrophyte, herbaceous perennials or annuals

#### Characteristics

<b>Pollen class</b>	Inaperturate
<b>Pollen grain shape</b>	Rounded to slightly elongated or egg-shaped
<b>Pollen grain size</b>	15.5-25.5 μm
<b>Aperture</b>	None
<b>Sculpture</b>	Reticulate, retipilate, brochi max. 2 μm
<b>Sporoderm</b>	Exine 1 μm
<b>Ecology</b>	High abundances indicate water depth ca. 0.1-2 m (Harrison & Digerfeldt 1990)

### *Hydrocharis* type

						
TP-2009 123.88 m				TP-2009 123.96 m		
						
TP-2009 126.98 m						


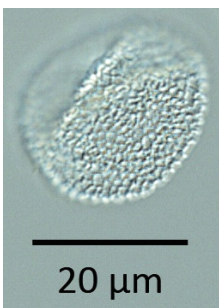
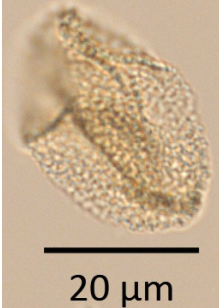

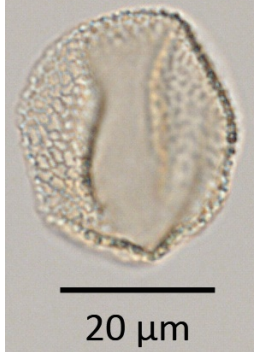


#### General remarks

<b>Plant family</b>	Hydrocharitaceae
<b>Common names (English/German)</b>	Tape-grasses Frostbissgewächse
<b>Palynomorph group</b>	<a href="#">Aquatic</a>
<b>Growth form</b>	Hydrophyte, herbaceous perennials

#### Characteristics

<b>Pollen class</b>	Inaperturate
<b>Pollen grain shape</b>	
<b>Pollen grain size</b>	18.0-34.0 µm
<b>Aperture</b>	None
<b>Sculpture</b>	Echinate, 1 µm
<b>Sporoderm</b>	Exine 0.5 µm

### *Potamogeton* type

 		 	
TP-2009 124.50 m		TP-2009 121.21 m	
 			
TP-2009 121.45 m		TP-2009 121.41 m	

#### General remarks

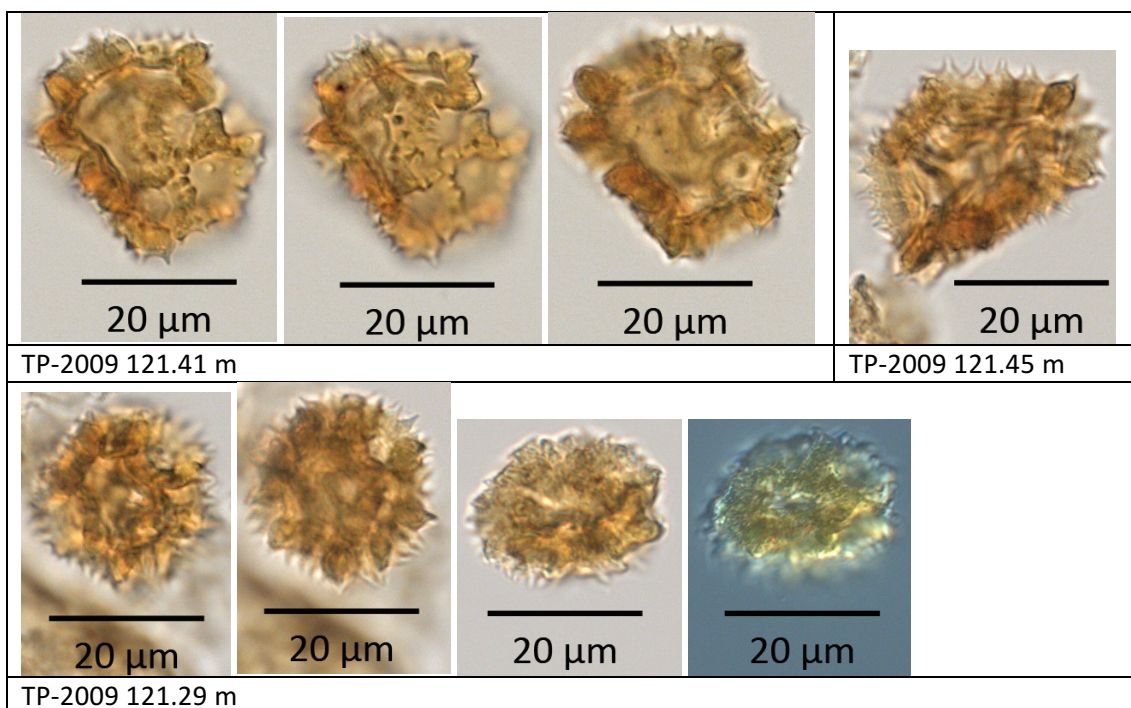
<b>Plant family</b>	Potamogetonaceae
<b>Common names (English/German)</b>	Pondweed Laichkräuter
<b>Palynomorph group</b>	Aquatic
<b>Growth form</b>	Hydrophyte, herbaceous perennials

#### Characteristics

<b>Pollen class</b>	Inaperturate
<b>Pollen grain shape</b>	Sphaeroid-prolate
<b>Pollen grain size</b>	15.7-53.8 µm
<b>Aperture</b>	None
<b>Sculpture</b>	Reticulate, brochi 1-4 µm
<b>Sporoderm</b>	
<b>Ecology</b>	Prefers fresh-oligohaline conditions and water depths of 0.25-3.9 m (Hannon & Gaillard 1997, Brush & Hilgartner 2000, Herzsuh et al. 2005)

# Fenestratae

## Cichorioideae p.p.



### General remarks

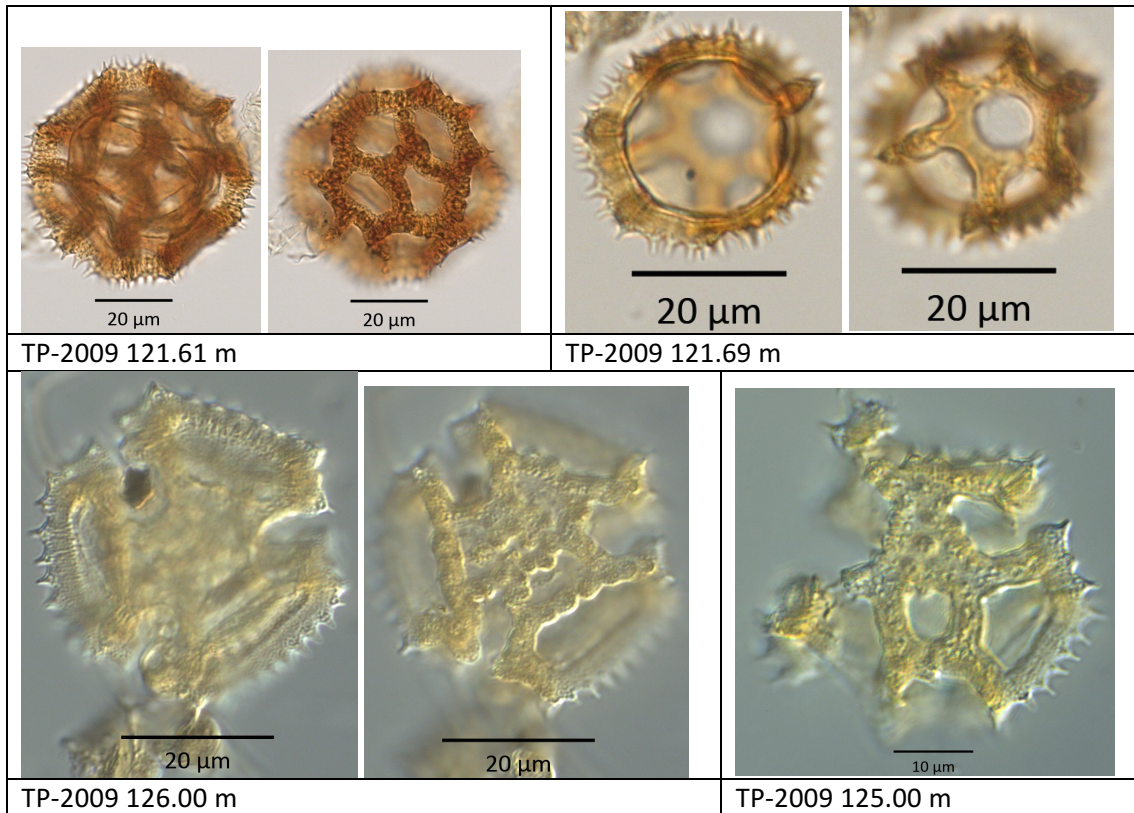
<b>Plant family</b>	Asteraceae
<b>Common names (English/German)</b>	Zungenblütler
<b>Palynomorph group</b>	Non-arboreal pollen
<b>Growth form</b>	Herbaceous perennials to annuals

### Characteristics

<b>Pollen class</b>	Fenestrate
<b>Pollen grain shape</b>	
<b>Pollen grain size</b>	27.0-59.8 µm
<b>Aperture</b>	None
<b>Sculpture</b>	Echinate
<b>Sporoderm</b>	



**Cichorioideae**  
***Crepis* type**



**General remarks**

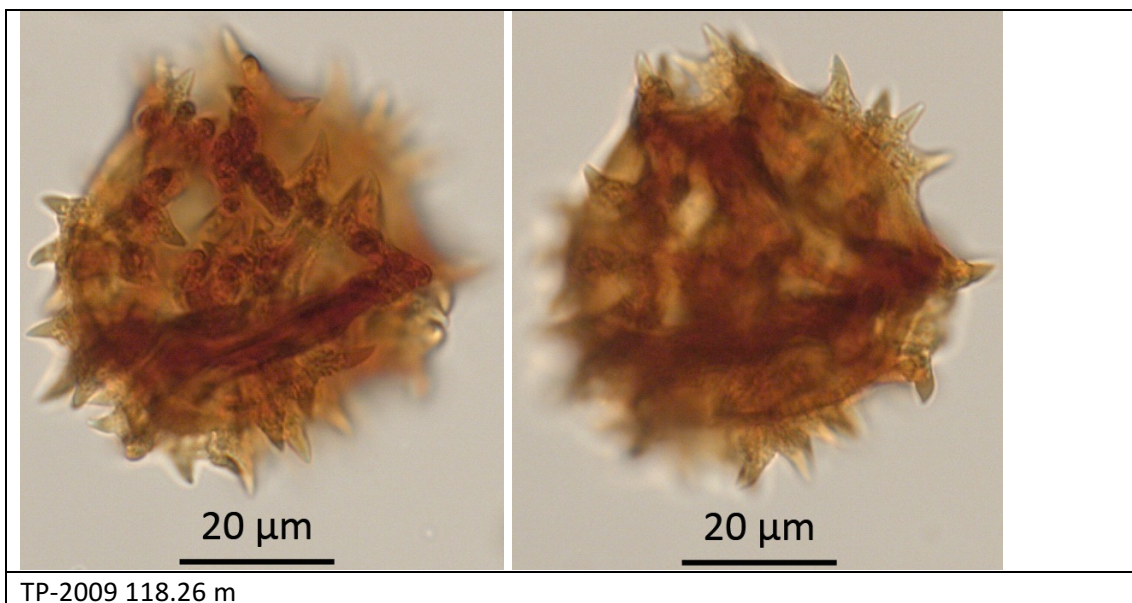
<b>Plant family</b>	Asteraceae
<b>Common names (English/German)</b>	Hawksbeard Pippau
<b>Palynomorph group</b>	Non-arboreal pollen
<b>Growth form</b>	Herbaceous perennials, annuals or biennials

**Characteristics**

<b>Pollen class</b>	Fenestrate
<b>Pollen grain shape</b>	3 poral and 6 parapolar lacunae
<b>Pollen grain size</b>	27.0-59.8 µm
<b>Aperture</b>	None
<b>Sculpture</b>	1 row with echini
<b>Sporoderm</b>	



## Cichorioideae

*Scorzonera humilis* type

TP-2009 118.26 m

## General remarks

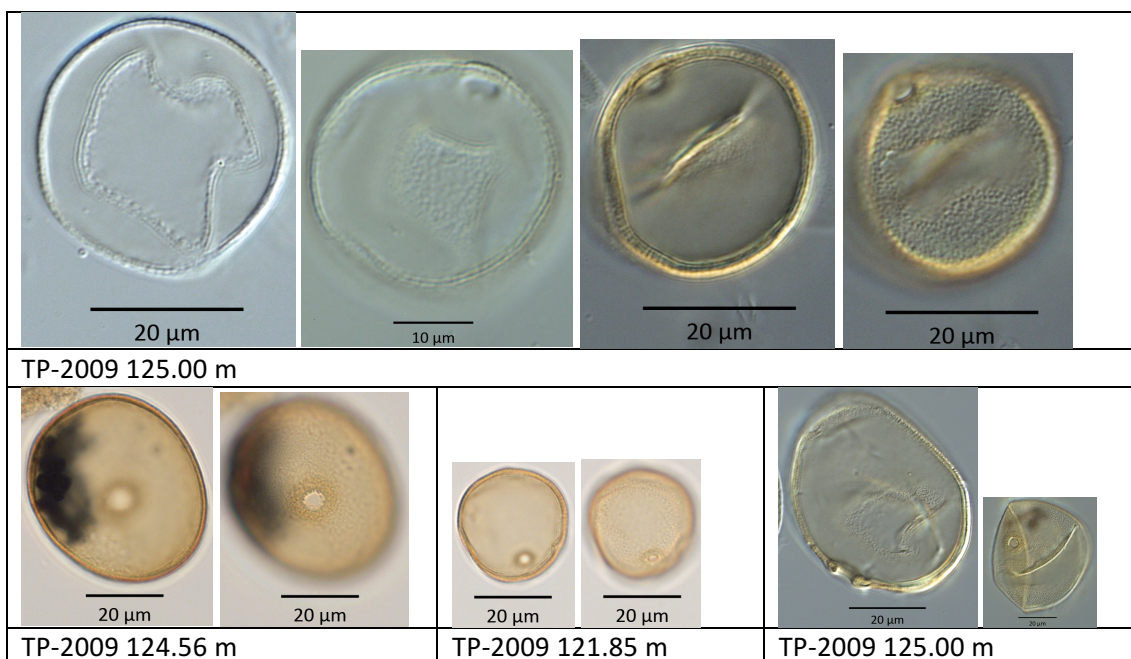
<b>Plant family</b>	Asteraceae
<b>Common names (English/German)</b>	Viper's grass Niedrige Schwarzwurzel
<b>Palynomorph group</b>	Non-arboreal pollen
<b>Growth form</b>	Herbaceous perennials

## Characteristics

<b>Pollen class</b>	Fenestrate
<b>Pollen grain shape</b>	Sphaeroid-circular, 3 poral lacunae
<b>Pollen grain size</b>	44.5-65.5 µm
<b>Aperture</b>	None
<b>Sculpture</b>	Echinate, max. 6 µm long
<b>Sporoderm</b>	Exine without echini 3-5(>5) µm Columellae: outer max. 11 µm with echini; inner <1 µm

# Monoporatae

## Poaceae (= Gramineae)



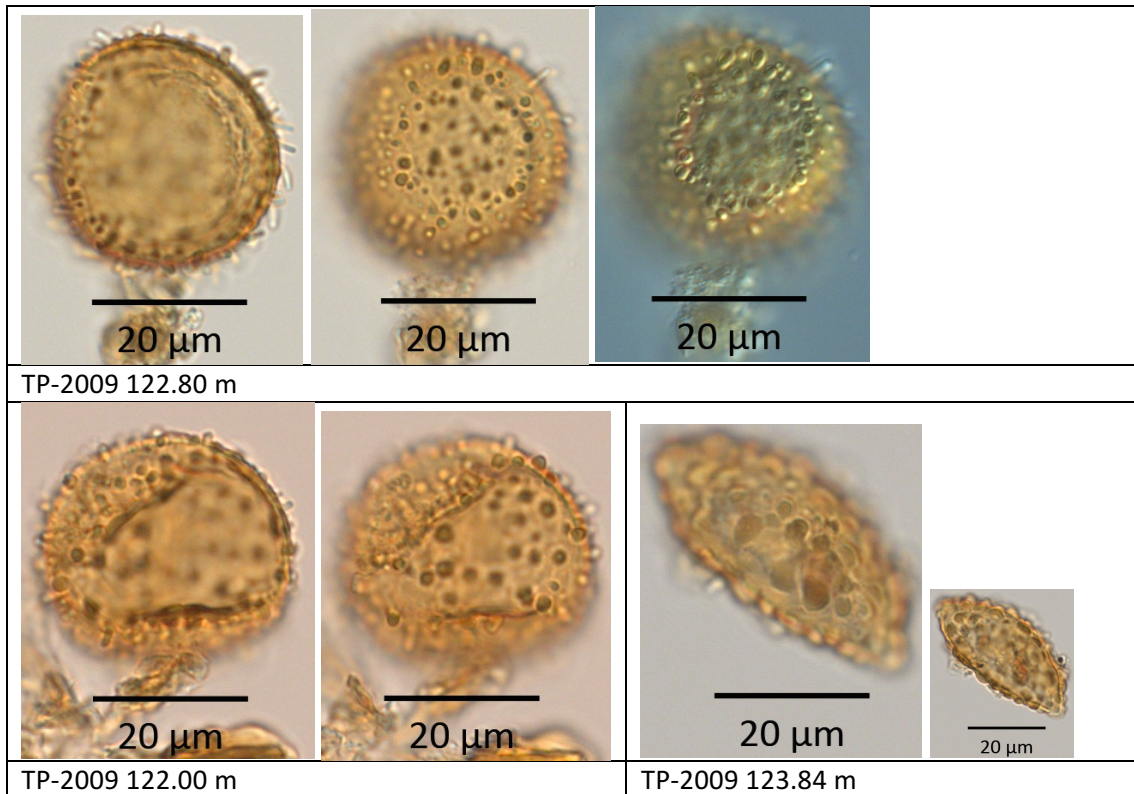
### General remarks

<b>Plant family</b>	Poaceae
<b>Common names (English/German)</b>	True grasses Süßgräser
<b>Palynomorph group</b>	Non-arboreal pollen
<b>Growth form</b>	Herbaceous perennials to annuals

### Characteristics

<b>Pollen class</b>	Monoporate
<b>Pollen grain shape</b>	Sphaeroid-prolate
<b>Pollen grain size</b>	15.9-138.0 µm
<b>Aperture</b>	Pore 1.6-9.3 µm, annulus 1.5-6.6 µm, with costa
<b>Sculpture</b>	Tectate, scabrate to microechinate
<b>Sporoderm</b>	
<b>Ecology</b>	Steppe element indicating cold and/or dry steppe conditions; Poaceae are typically shallow-rooted plants that tend to proliferate in wetter conditions in comparison to other NAP (Li et al. 2010)

## Nymphaea



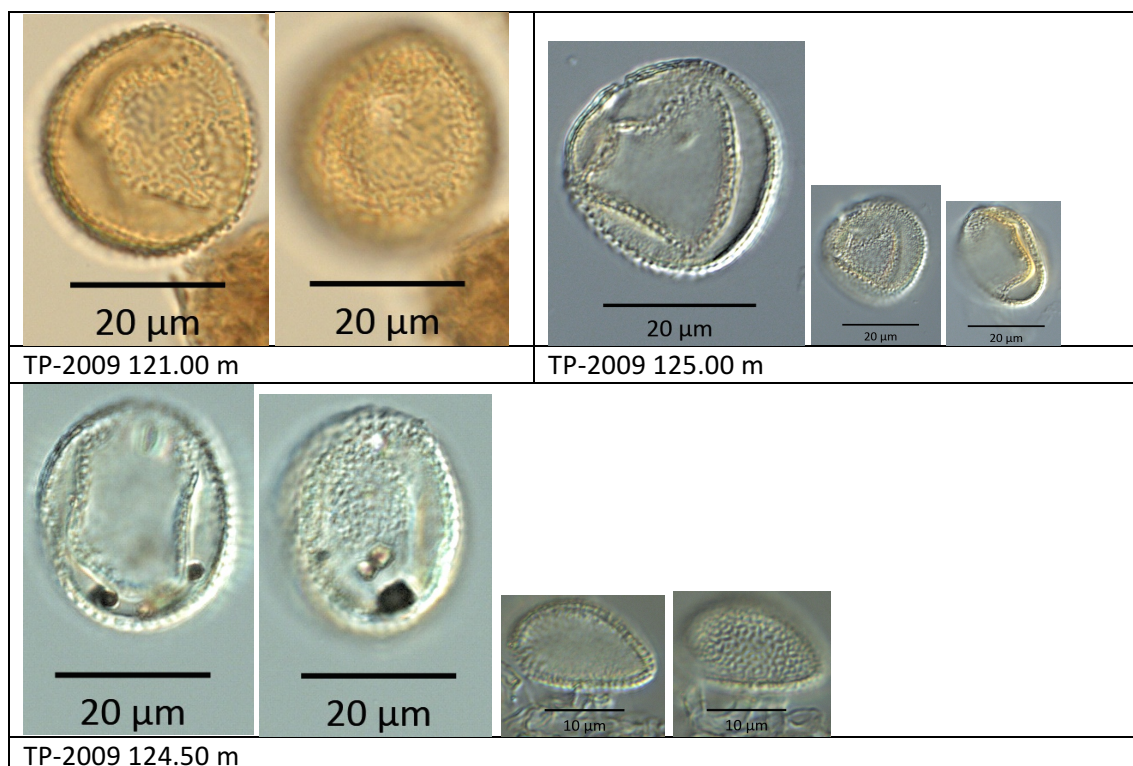
### General remarks

<b>Plant family</b>	Nymphaeaceae
<b>Common names (English/German)</b>	Water-lilies Seerosen
<b>Palynomorph group</b>	Aquatic
<b>Growth form</b>	Hydrophyte, herbaceous perennials (mostly)

### Characteristics

<b>Pollen class</b>	Monoporate
<b>Pollen grain shape</b>	Oblate-sphaeroid
<b>Pollen grain size</b>	23.8-53.0 µm
<b>Aperture</b>	Pore large, operculate; operculum verrucate, or marginal verrucate and at centre psilate
<b>Sculpture</b>	Heteropolar: distal clavate, gemmate and/or baculate; proximal with pore
<b>Sporoderm</b>	
<b>Ecology</b>	Prefers open water environment, but grows less deep than <i>Myriophyllum</i> in water depths of 0.1-3 m (Harrison & Digerfeldt 1990, Hannon & Gaillard 1997)

### *Sparganium* type



#### General remarks

<b>Plant family</b>	Typhaceae
<b>Common names (English/German)</b>	Bur-reed Igelkolben
<b>Palynomorph group</b>	<a href="#">Aquatic</a>
<b>Growth form</b>	Indeciduous hydrophyte, herbaceous perennials

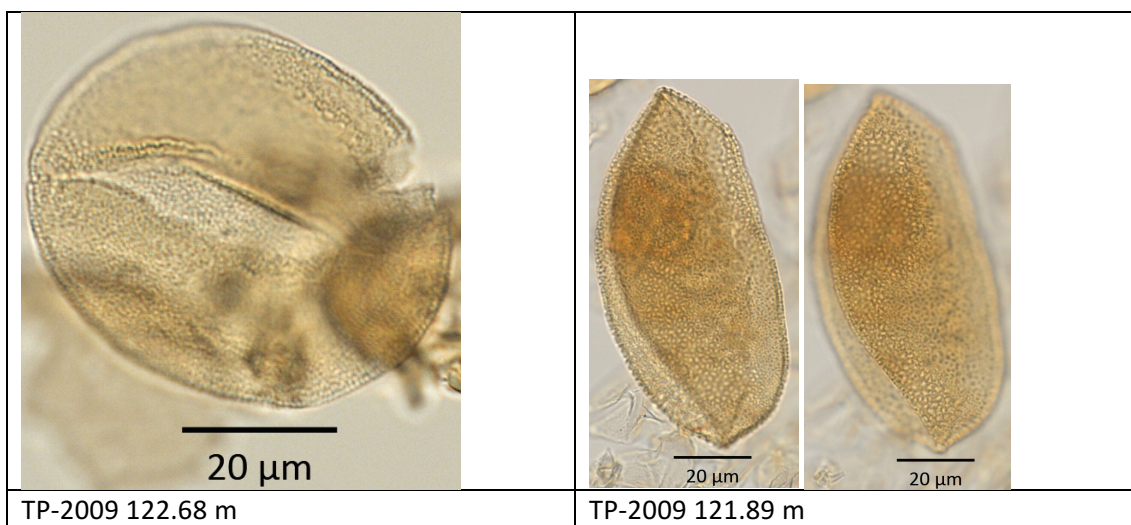
#### Characteristics

<b>Pollen class</b>	Monoporate
<b>Pollen grain shape</b>	Sphaeroid-ovate/rounded-angular
<b>Pollen grain size</b>	19.4-37.5 µm
<b>Aperture</b>	Pore large, 3.0-6.0(-8.0) µm
<b>Sculpture</b>	Reticulate
<b>Sporoderm</b>	Exine 1.8-2.1 µm
<b>Ecology</b>	Indicates eutrophic conditions, prefers lower lake levels, but does not grow in swamps (van der Wiel & Wijmstra 1987, Hannon & Gaillard 1997)

# Monocolpatae



### *Asphodelus* group



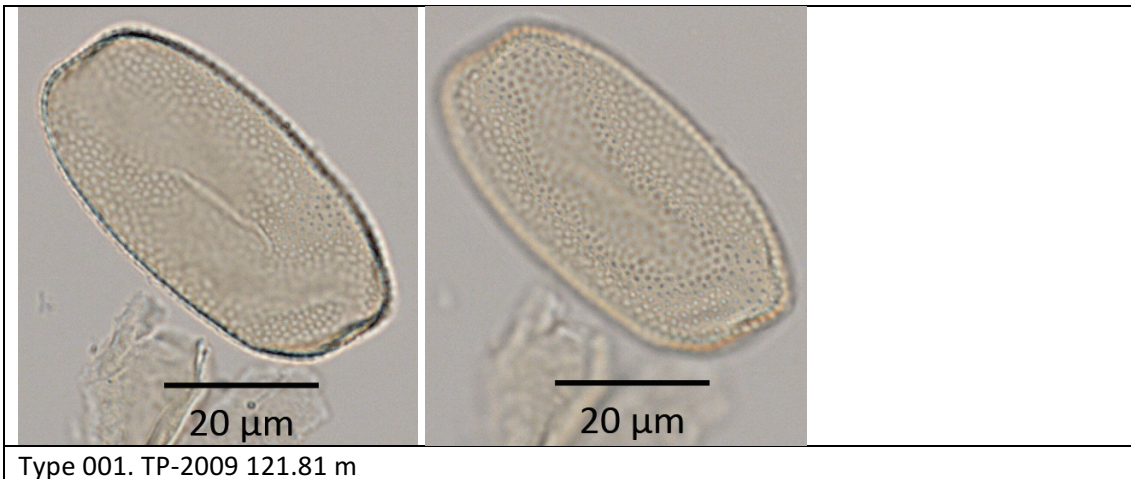
#### General remarks

<b>Plant family</b>	Xanthorrhoeaceae
<b>Common names (English/German)</b>	Asphodel Affodill
<b>Palynomorph group</b>	Non-arboreal pollen
<b>Growth form</b>	Herbaceous perennials (mainly)

#### Characteristics

<b>Pollen class</b>	Monocolpate
<b>Pollen grain shape</b>	Peroblate, polar circular
<b>Pollen grain size</b>	45.0-109.4 µm
<b>Aperture</b>	Colpus polar thickest, 5-10 µm
<b>Sculpture</b>	Reticulate, tectum imperforatum or tectum perforatum, brochi max. 3 µm, muri 1 to >1 µm; iso- or heteropolar
<b>Sporoderm</b>	Exine 1.5-5 µm

## Liliaceae p.p.



### General remarks

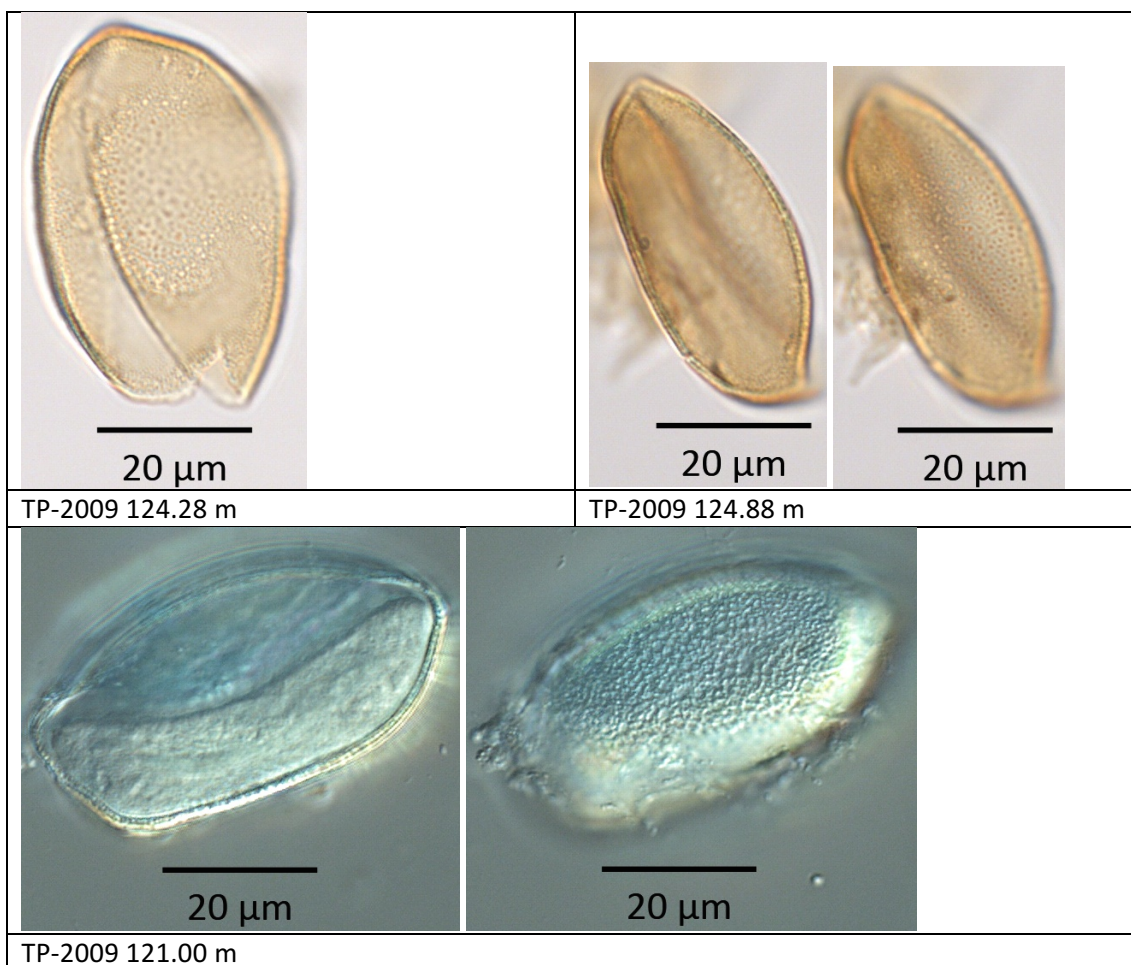
<b>Plant family</b>	Liliaceae
<b>Common names (English/German)</b>	Lilies Liliengewächse
<b>Palynomorph group</b>	Non-arboreal pollen
<b>Growth form</b>	Herbaceous perennials (mainly)

### Characteristics

<b>Pollen class</b>	Monocolpate
<b>Pollen grain shape</b>	Prolate
<b>Pollen grain size</b>	68.0-101.8 µm
<b>Aperture</b>	(± margo)
<b>Sculpture</b>	Reticulate, brochi 3-15 µm, muri max. 2 µm
<b>Sporoderm</b>	Exine (2.5-)3-4 µm



### *Ornithogalum* type





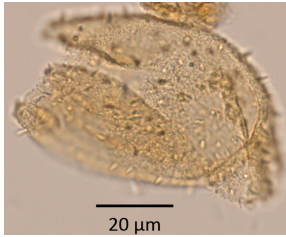
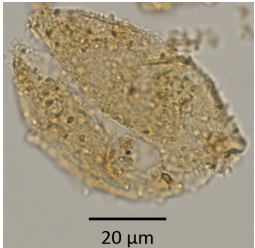
#### General remarks

<b>Plant family</b>	Asparagaceae
<b>Common names (English/German)</b>	Star-of-Bethlehem Milchsterne
<b>Palynomorph group</b>	Non-arboreal pollen
<b>Growth form</b>	Herbaceous perennials

#### Characteristics

<b>Pollen class</b>	Monocolpate
<b>Pollen grain shape</b>	Prolate
<b>Pollen grain size</b>	41.3-101.8 μm
<b>Aperture</b>	Colpus broad
<b>Sculpture</b>	Reticulate, heterobrochate, large 2-4 μm, small 1-2.5 μm; between brochi psilate
<b>Sporoderm</b>	Exine 1.0-1.8 μm

*Stratiotes aloides*

			
TP-2009 123.96 m		TP-2009 122.20 m	TP-2009 122.08 m

**General remarks**

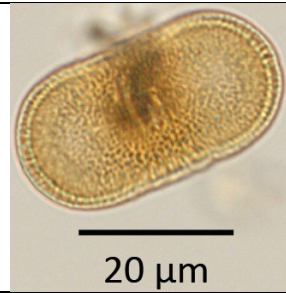
<b>Plant family</b>	Hydrocharitaceae
<b>Common names (English/German)</b>	Water soldier Krebsschere
<b>Palynomorph group</b>	Aquatic
<b>Growth form</b>	Hydrophyte, submerged

**Characteristics**

<b>Pollen class</b>	Monocolpate
<b>Pollen grain shape</b>	Sphaeroid to slightly elongated
<b>Pollen grain size</b>	48.0-72.3 µm
<b>Aperture</b>	Colpus indistinct
<b>Sculpture</b>	Echinate, 2-4 µm long, 1 µm broad
<b>Sporoderm</b>	Exine 1.8-2.0 µm
<b>Ecology</b>	Prefers cooling conditions (pers. comm. M. Knipping)

# Dicolporatae

## *Tordylium maximum*



TP-2009 127.10 m

### General remarks


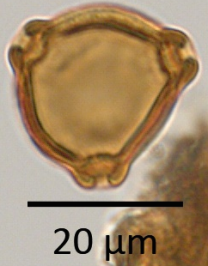

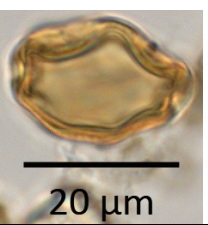
<b>Plant family</b>	Apiaceae
<b>Common names (English/German)</b>	Hartwort Große Zirmet
<b>Palynomorph group</b>	Non-arboreal pollen
<b>Growth form</b>	Herbaceous biennials or annuals

### Characteristics

<b>Pollen class</b>	Dicolporate, 2-4 colpi or pori
<b>Pollen grain shape</b>	Prolate to perprolate, polar flattened
<b>Pollen grain size</b>	19.5-32.8 µm
<b>Aperture</b>	Pori 2.0-3.0 x 5.0-7.0 µm, eq. elongated, ± with costae Colpi short apertures on flatter side
<b>Sculpture</b>	Retipilate or slightly reticulate, muri very thin
<b>Sporoderm</b>	Exine eq. (3.0-)3.5-4.0. polar 3.0-3.5 µm Endexine 1.0-1.2 µm Columellae eq. 1.3-1.7 µm, polar 1.0 µm, polar and subeq. thicker than eq. Tectum eq. corrugated

# Triporatae

***Betula***

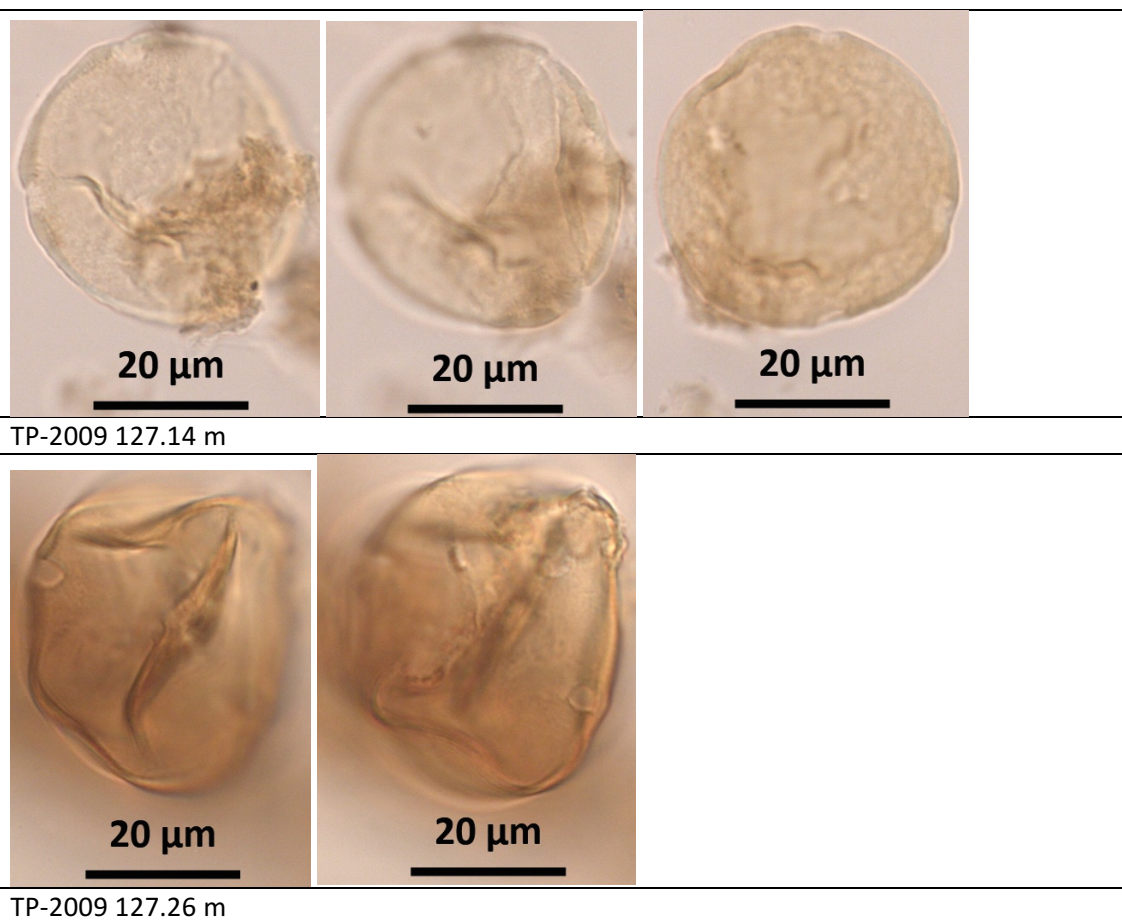
				
TP-2009 121.21 m			TP-2009 123.24 m	
				
TP-2009 121.08 m			TP-2009 123.80 m	

**General remarks**

<b>Plant family</b>	Betulaceae
<b>Common names (English/German)</b>	Birch Birke
<b>Palynomorph group</b>	Arboreal pollen
<b>Growth form</b>	Deciduous tree (± shrub)

**Characteristics**

<b>Pollen class</b>	Triporate
<b>Pollen grain shape</b>	Sphaeroid-prolate, eq. angular
<b>Pollen grain size</b>	21.8-33.0 µm
<b>Aperture</b>	Pori circular to elliptic, 2.0-3.8 µm; vestibula 6.5-10.5 µm broad, 1.7-2.9 µm high
<b>Sculpture</b>	Scabrate
<b>Sporoderm</b>	Exine 1.1-1.6 µm
<b>Ecology</b>	Pioneer plant, that grows fast and grows in low nutrient soils

*Carya***General remarks**

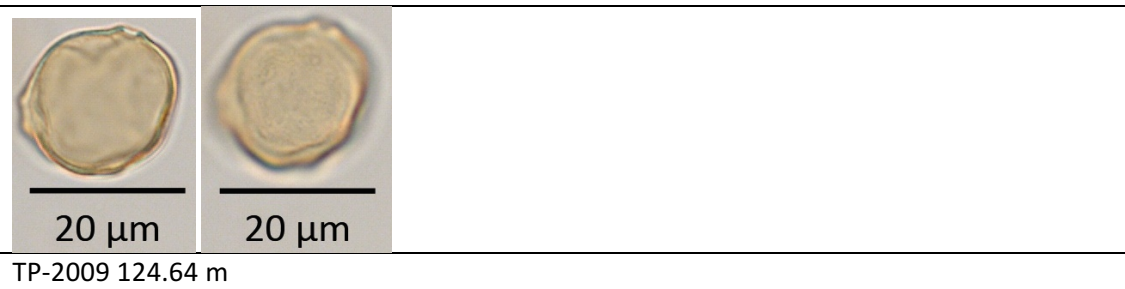
<b>Plant family</b>	Juglandaceae
<b>Common names (English/German)</b>	Hickory Hickory
<b>Palynomorph group</b>	Arboreal pollen
<b>Growth form</b>	Deciduous tree

**Characteristics**

<b>Pollen class</b>	Triporate ( $\pm$ tetraporate)
<b>Pollen grain shape</b>	Oblate ( $\pm$ sphaeroid), triangular-rounded
<b>Pollen grain size</b>	39.8-66.8 $\mu$ m
<b>Aperture</b>	Pori circular to elliptic, 3.3-5.5 $\mu$ m
<b>Sculpture</b>	Scabrate, consistent dotted pattern
<b>Sporoderm</b>	Exine 2.2-2.8 $\mu$ m Columellae thin



## *Humulus* type



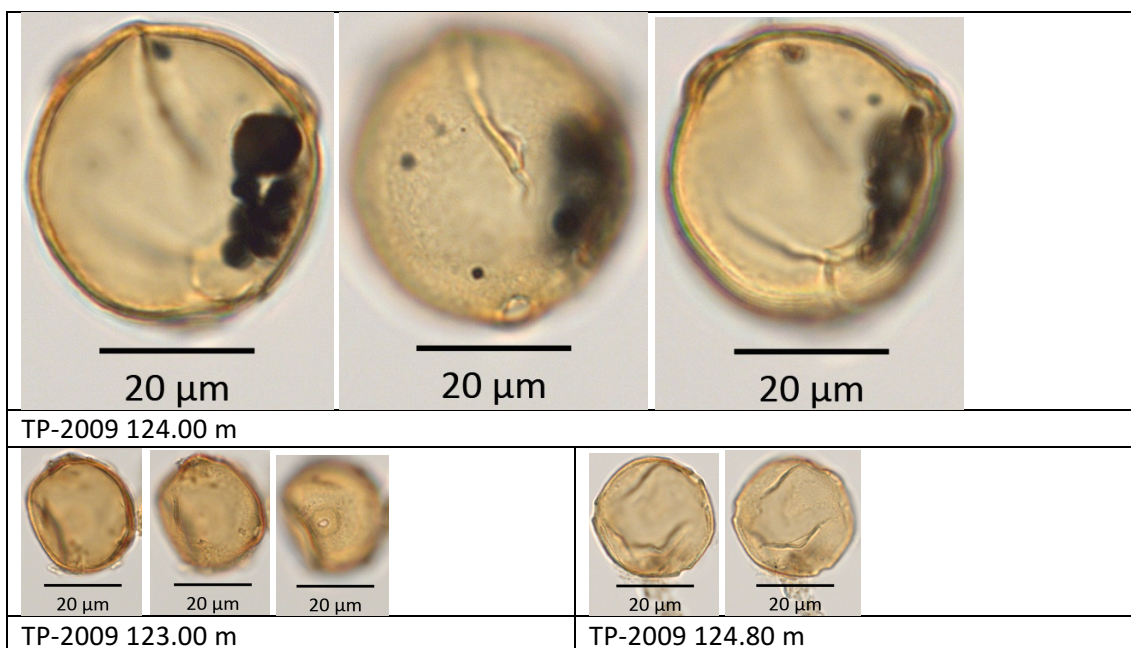
### General remarks

<b>Plant family</b>	Cannabaceae
<b>Common names (English/German)</b>	Hop Hopfen
<b>Palynomorph group</b>	Arboreal pollen
<b>Growth form</b>	Creeper, herbaceous perennials to annuals

### Characteristics

<b>Pollen class</b>	Triporate
<b>Pollen grain shape</b>	Sphaeroid-circular to slightly prolate
<b>Pollen grain size</b>	20.5-27.8 µm, smaller than <i>Cannabis</i> (<24 µm)
<b>Aperture</b>	Pori with annulus
<b>Sculpture</b>	Psilate
<b>Sporoderm</b>	Exine (1.0-)1.2-1.5 µm, sporoderm thin-walled

*Carpinus orientalis/Ostrya carpinifolia* type

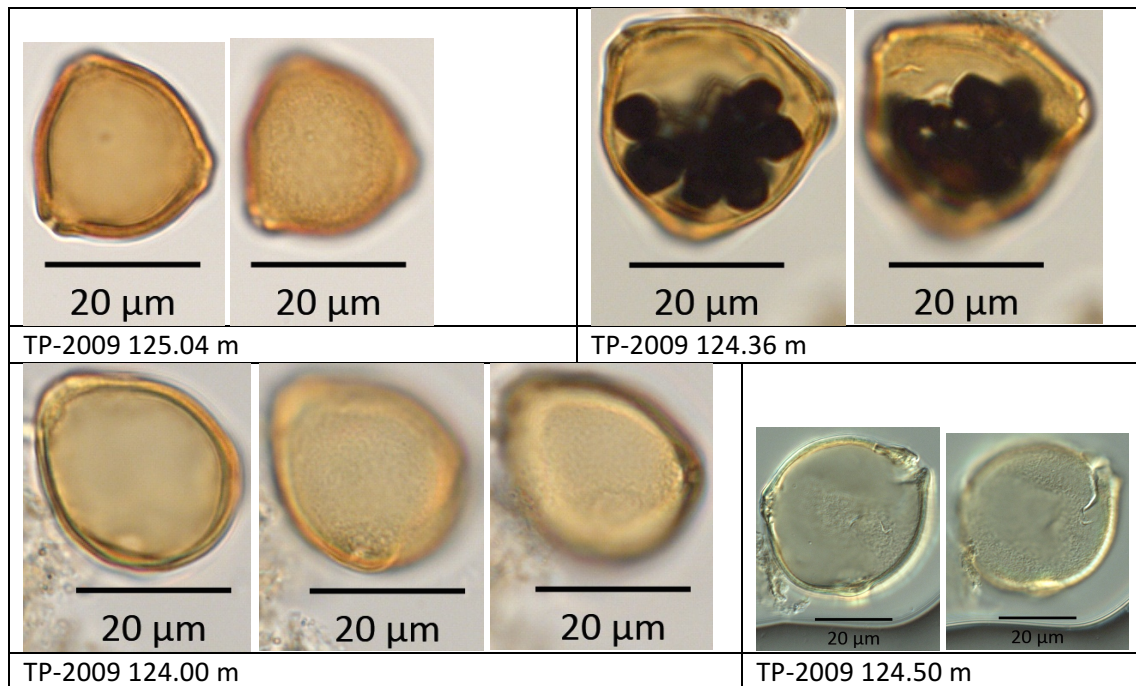


**General remarks**

<b>Plant family</b>	Betulaceae
<b>Common names (English/German)</b>	Oriental Hornbeam/Hophornbeam Orientalische Hainbuche/Europäische Hopfenbuche
<b>Palynomorph group</b>	Arboreal pollen
<b>Growth form</b>	Deciduous tree

**Characteristics**

<b>Pollen class</b>	Triporate
<b>Pollen grain shape</b>	Sphaeroid, polar circular, eq. broad elliptic
<b>Pollen grain size</b>	29.3-36.5 µm
<b>Aperture</b>	Pori 2.2-3.0 µm, vestibula 6.5-9.0 µm broad, 1.8-2.0 µm high
<b>Sculpture</b>	Slightly scabrate
<b>Sporoderm</b>	Exine 1.2-1.7 µm
<b>Ecology</b>	Requires warm conditions and higher moisture availability (Christanis 1983)

*Corylus***General remarks**

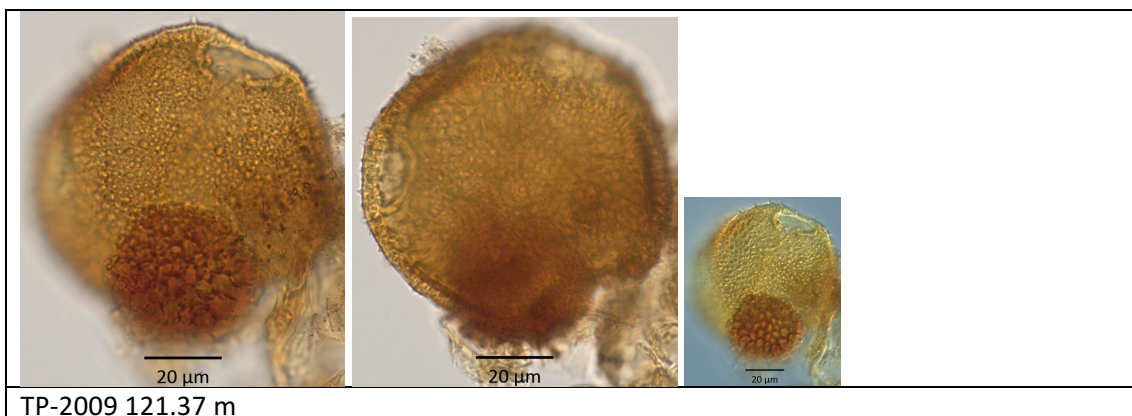
<b>Plant family</b>	Betulaceae
<b>Common names (English/German)</b>	Hazel Haseln
<b>Palynomorph group</b>	Arboreal pollen
<b>Growth form</b>	Deciduous tree (± shrub)

**Characteristics**

<b>Pollen class</b>	Triporate
<b>Pollen grain shape</b>	Prolate flattened, polar triangular
<b>Pollen grain size</b>	26.3-40.8 µm
<b>Aperture</b>	Pori without vestibula
<b>Sculpture</b>	Scabrate, elements rounded to elongated
<b>Sporoderm</b>	Exine 1.5-1.8 µm

## Dipsacaceae

### *Knautia*



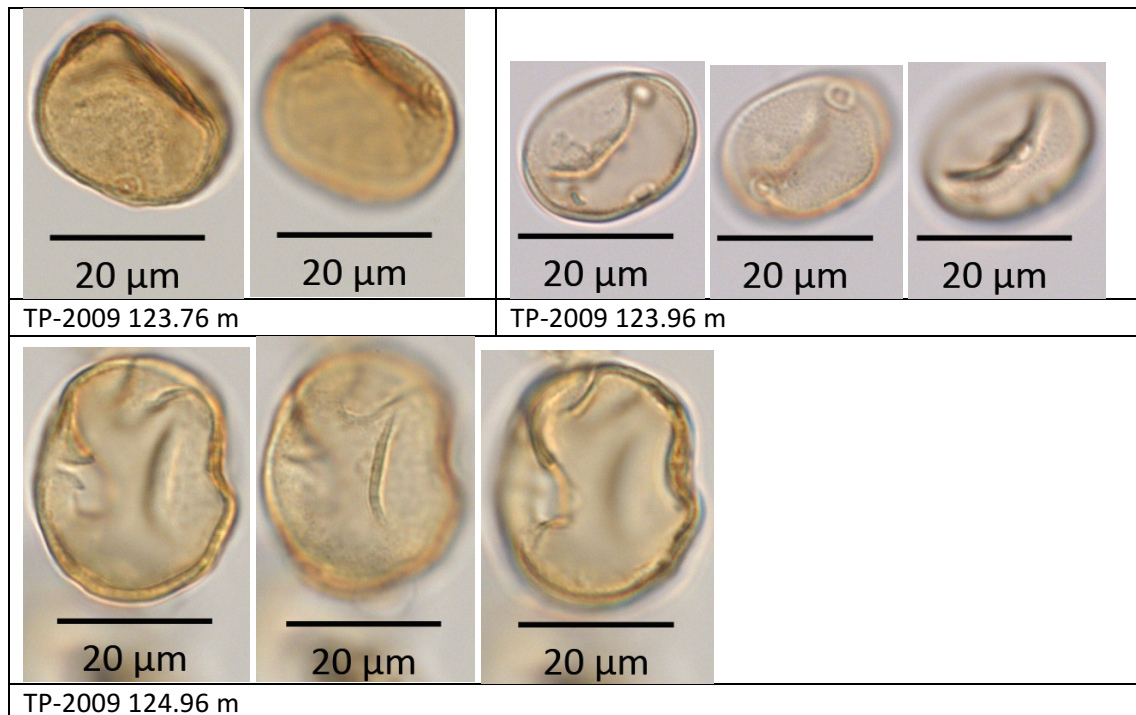
#### General remarks

<b>Plant family</b>	Caprifoliaceae
<b>Common names (English/German)</b>	Widow flower Witwenblumen
<b>Palynomorph group</b>	Non-arboreal pollen
<b>Growth form</b>	Herbaceous perennials to annuals

#### Characteristics

<b>Pollen class</b>	Triporate
<b>Pollen grain shape</b>	Sphaeroid to oblate, polar rounded-angular
<b>Pollen grain size</b>	69.3-123.0 µm
<b>Aperture</b>	Pori circular, 7.5-17 µm (± elliptic, 7.5-15.5 x 15.0-22.5 µm)
<b>Sculpture</b>	Dimorph echinate, large echini 2.0-2.5 µm broad, (2.5-)3-4 µm long, 3-17 µm distance, small echini 1-2 µm long, distance 1-2 µm
<b>Sporoderm</b>	Exine 4.8-6.0(-6.5) µm Columellae two-layerd: inner hick and long elements

## Urticaceae/Moraceae



### General remarks

<b>Plant family</b>	Urticaceae/Moraceae
<b>Common names (English/German)</b>	Nettle family/mulberry or fig family Brennnesselgewächse/Maulbeer-gewächse
<b>Palynomorph group</b>	Non-arboreal pollen
<b>Growth form</b>	Herbaceous perennials to annuals

### Characteristics


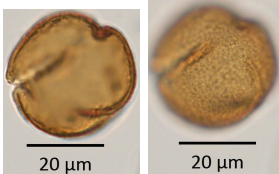


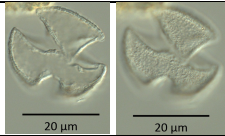
<b>Pollen class</b>	Triporate (± diporate, tetraporate)
<b>Pollen grain shape</b>	Globose to elliptic
<b>Pollen grain size</b>	11.0-37.5 µm
<b>Aperture</b>	Pori mostly with annulus
<b>Sculpture</b>	Scabrate, elements punctiform, 0.5-0.8 µm
<b>Sporoderm</b>	Exine 0.8-1.0 µm Columellae mostly not visible

# Tricolpatae

psilate, scabrate, verrucate, microverrucate



### *Quercus cerris* type

			
TP-2009 121.69 m			TP-2009 123.08 m
			
<i>Quercus crenata</i> , TP-2009 125.00 m			TP-2009 123.08 m
			
TP-2009 124.50 m			

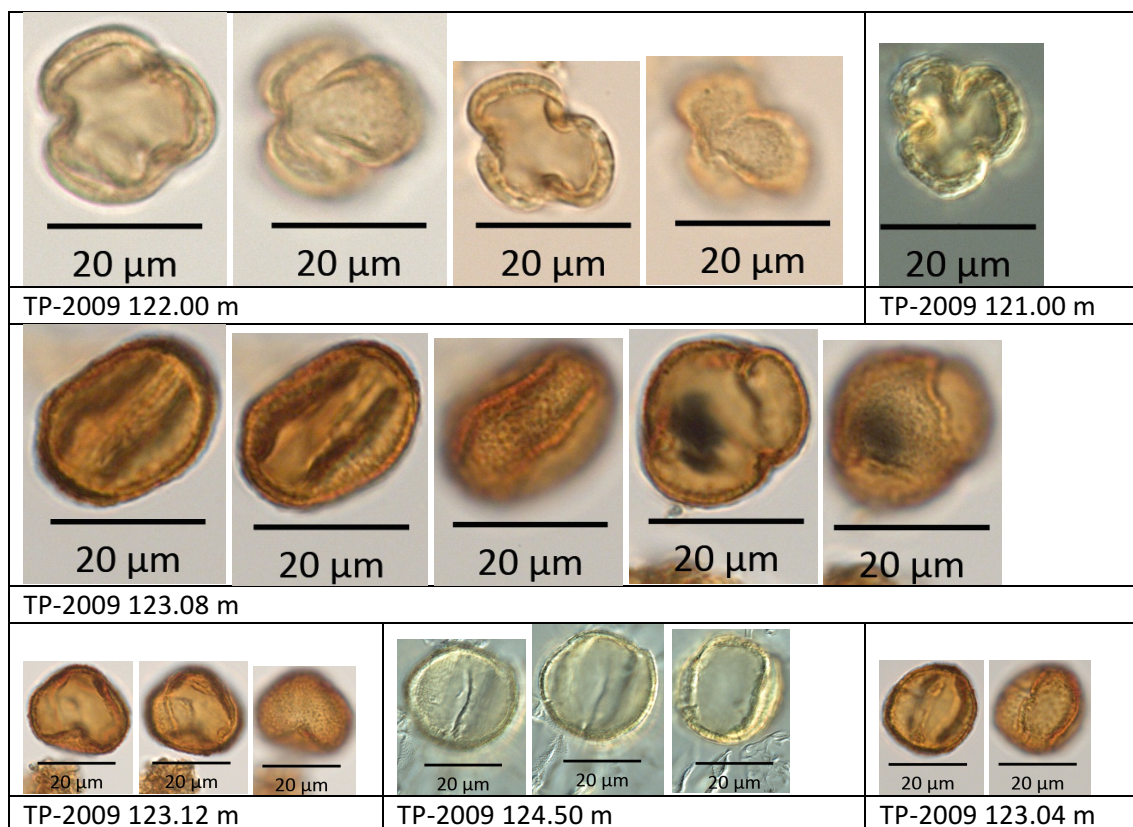
#### General remarks

<b>Plant family</b>	Fagaceae
<b>Common names (English/German)</b>	Turkey oak Zerreiche
<b>Palynomorph group</b>	Arboreal pollen
<b>Growth form</b>	Deciduous tree

#### Characteristics

<b>Pollen class</b>	Tricolpate
<b>Pollen grain shape</b>	Sphaeroid
<b>Pollen grain size</b>	24.5-32.0 µm
<b>Aperture</b>	Colpi narrow, ± curved
<b>Sculpture</b>	Scabrate
<b>Sporoderm</b>	
<b>Remarks</b>	<i>Q. cerris</i> type is more sphaeroid and the colpi more angular than in <i>Q. robur/pubescens</i> type
<b>Ecology</b>	Requires warm conditions and higher moisture availability, reflect annual precipitation of at least 550 mm but more probably in the range of 800-1300 mm yr <sup>-1</sup> and year-round moisture and/or reflect drought resistance (<600 mm yr <sup>-1</sup> ) (Rossignol-Strick 1999)

## *Quercus ilex* type



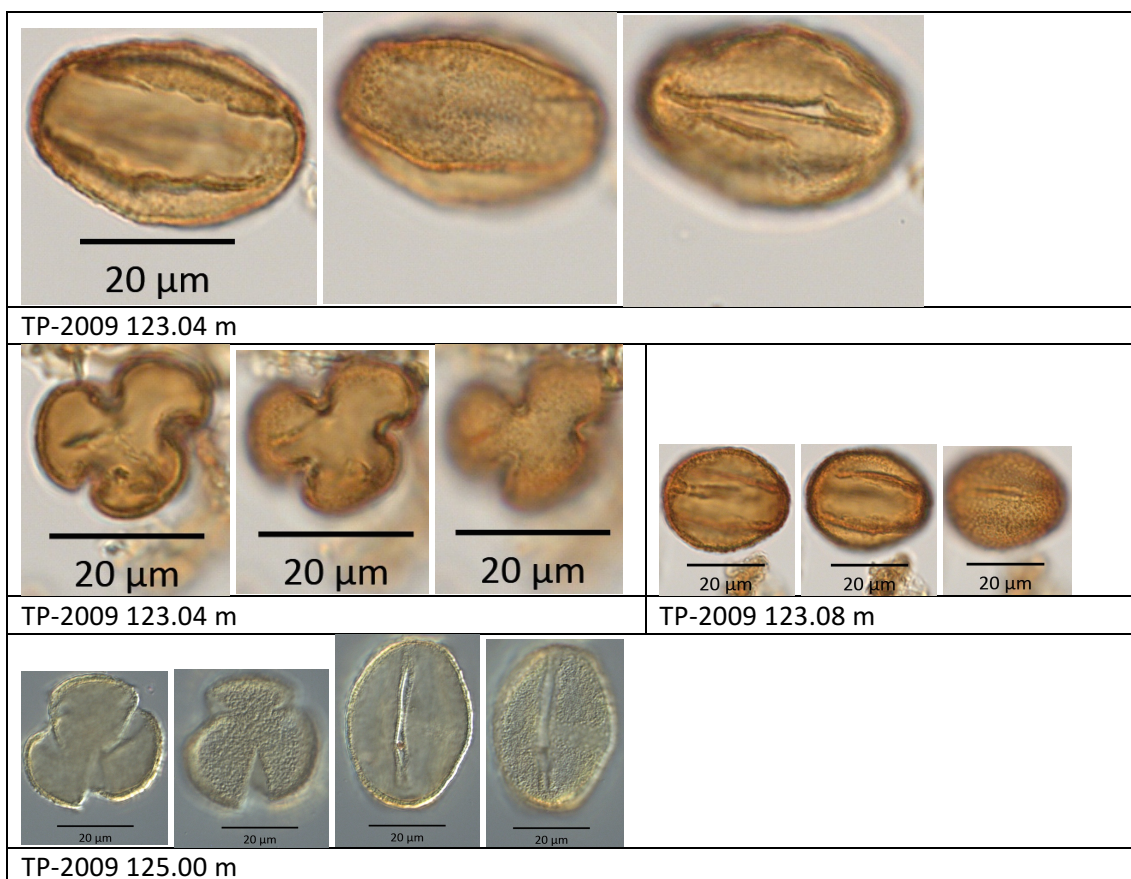
### General remarks

<b>Plant family</b>	Fagaceae
<b>Common names (English/German)</b>	Evergreen oak Steineiche
<b>Palynomorph group</b>	Arboreal pollen
<b>Growth form</b>	Indeciduous tree

### Characteristics

<b>Pollen class</b>	Tricolpate
<b>Pollen grain shape</b>	Rhomboid-sphaeroid or prolate with pointed ends
<b>Pollen grain size</b>	15.2-24.7 µm
<b>Aperture</b>	
<b>Sculpture</b>	Scabrate
<b>Sporoderm</b>	
<b>Ecology</b>	Native to Mediterranean region, requires frost-free winters and drier conditions (Christanis 1983) High abundances require mean winter temperature of $\geq 3$ °C (Barbero et al. 1992) Reach a peak during periods of hot dry summers and mild wet winters (Quézel 1981)

## *Quercus robur/pubescens* type



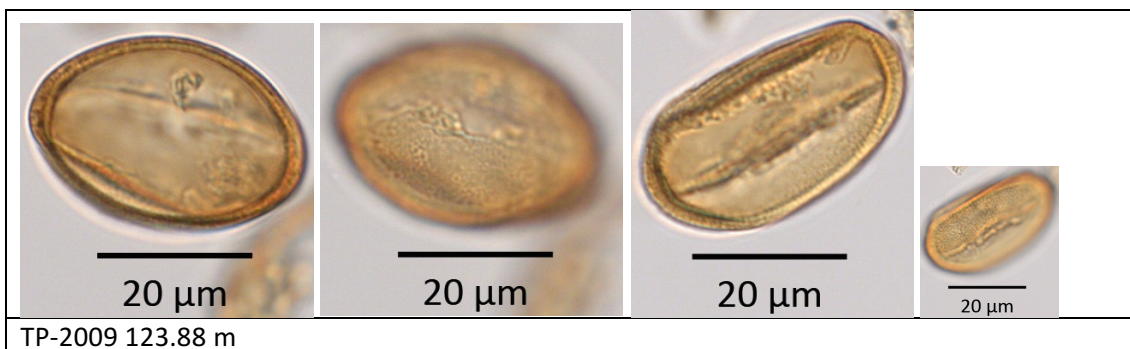
### General remarks

<b>Plant family</b>	Fagaceae
<b>Common names (English/German)</b>	English oak/Downy oak Stieleiche/Flaumeiche
<b>Palynomorph group</b>	Arboreal pollen
<b>Growth form</b>	Deciduous tree

### Characteristics

<b>Pollen class</b>	Tricolpate
<b>Pollen grain shape</b>	Prolate, polar barrel-shaped flattened
<b>Pollen grain size</b>	22.0-33.5 µm
<b>Aperture</b>	Colpi gape (ripping of colpi membrane), ± linear
<b>Sculpture</b>	Scabrate, elements diverse
<b>Sporoderm</b>	Exine 1-2 µm
<b>Remarks</b>	<i>Q. robur/pubescens</i> type is more prolate and the colpi more linear than in <i>Q. cerris</i> type
<b>Ecology</b>	Requires warm conditions and higher moisture availability, reflect annual precipitation of at least 550 mm but more probably in the range of 800-1300 mm yr <sup>-1</sup> and year-round moisture and/or reflect drought resistance (<600 mm yr <sup>-1</sup> ) (Rossignol-Strick 1999) Require higher summer soil water availability than evergreen <i>Quercus</i> , but can endure cold, dry winters (Damesin & Rambal 1995)

## *Aconitum* group



### General remarks

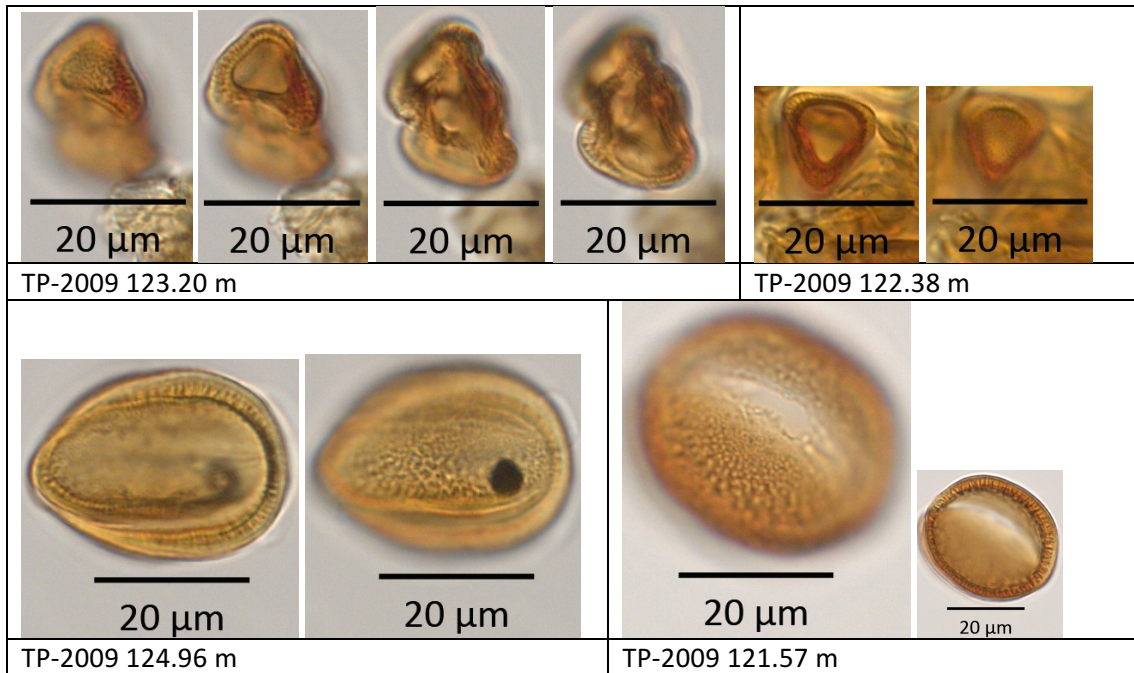
<b>Plant family</b>	Ranunculaceae
<b>Common names (English/German)</b>	Aconite Eisenhut
<b>Palynomorph group</b>	Non-arboreal pollen
<b>Growth form</b>	Herbaceous perennials

### Characteristics

<b>Pollen class</b>	Tricolpate
<b>Pollen grain shape</b>	Sphaeroid to prolate
<b>Pollen grain size</b>	16.9-41.8 µm
<b>Aperture</b>	
<b>Sculpture</b>	Psilate (± scabrate)
<b>Sporoderm</b>	Exine eq. and subpolar 0.8-1.8 µm, polar 2.0-3.5 µm thick
<b>Remarks</b>	Thinner walled and more coarse-granulose colpi than <i>Adonis aestivalis</i> type



***Alchemilla pentaphyllea* type (in *Alchemilla* group)**



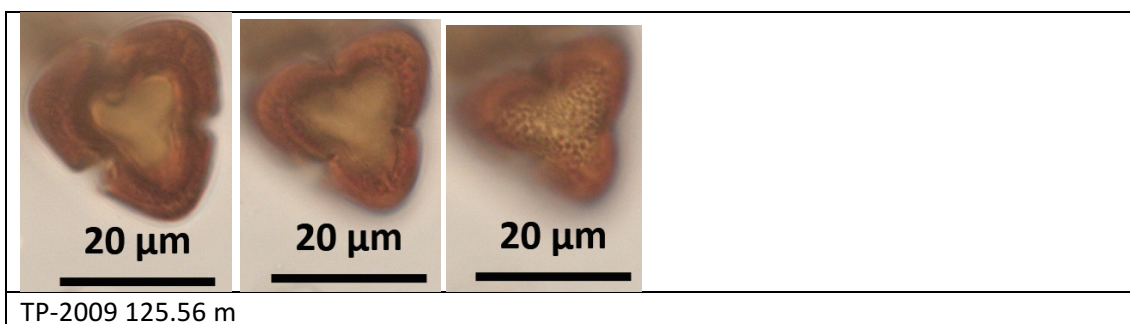
**General remarks**

<b>Plant family</b>	Rosaceae
<b>Common names (English/German)</b>	Lady's mantle Frauenmantel
<b>Palynomorph group</b>	Non-arboreal pollen
<b>Growth form</b>	Herbaceous perennials

**Characteristics**

<b>Pollen class</b>	Tricolpate
<b>Pollen grain shape</b>	Interangular, eq. 4/6-angular, often crippled
<b>Pollen grain size</b>	18.2-29.7 μm
<b>Aperture</b>	
<b>Sculpture</b>	Psilate or striate
<b>Sporoderm</b>	Exine max. 2.0-3.0 μm, eq. to subpolar <3 μm thick Columellae very distinct and characteristic

***Aphanes arvensis* type (in *Alchemilla* group)**



**General remarks**

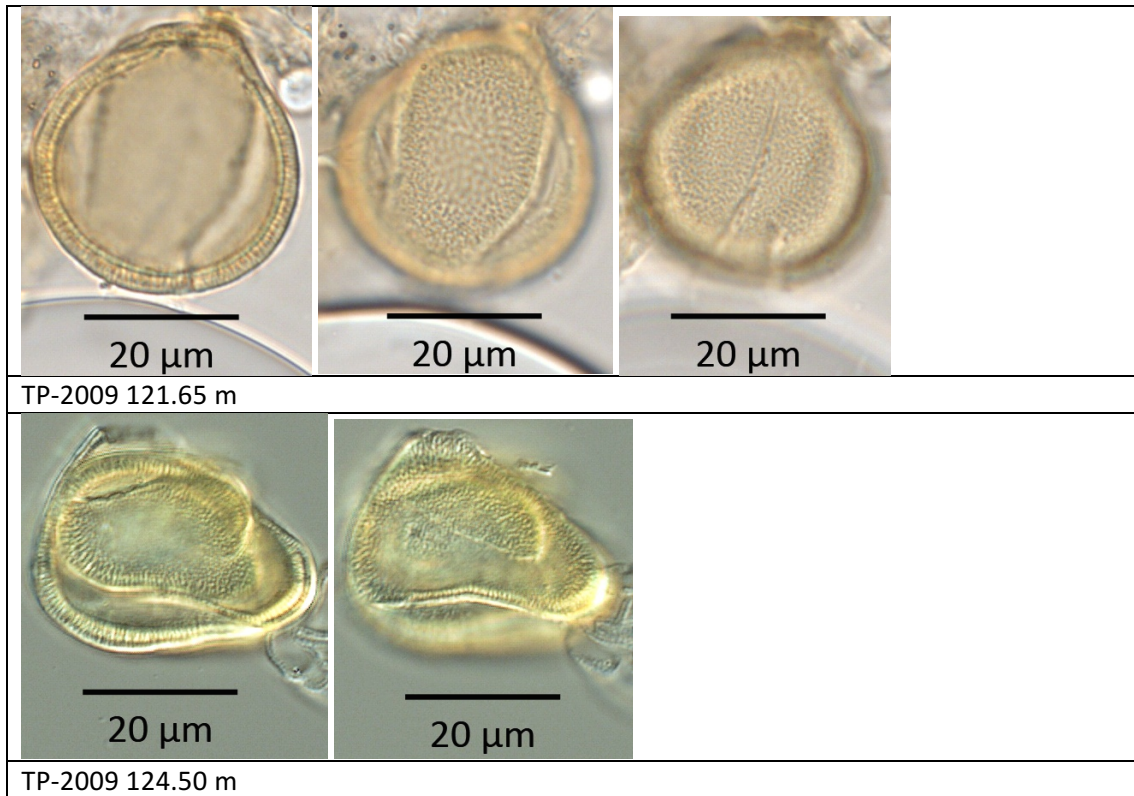
<b>Plant family</b>	Rosaceae
<b>Common names (English/German)</b>	Parsley-piert Ackerfrauenmantel
<b>Palynomorph group</b>	Non-arboreal pollen
<b>Growth form</b>	Herbaceous perennials

**Characteristics**

<b>Pollen class</b>	Tricolpate
<b>Pollen grain shape</b>	Interangular, polar triangular
<b>Pollen grain size</b>	21.5-29.7 µm
<b>Aperture</b>	Colpi ± recessed
<b>Sculpture</b>	Psilate
<b>Sporoderm</b>	Exine eq. max. 3.0-4.5 µm, polar 1.5-2.0 µm, eq. to subpolar 3-4 µm thick Endexine polar and subpolar 0.7 µm thick Tectum 0.5-0.8 µm thick Columellae different in size, thus exine thickness varying



### *Convolvulus* type



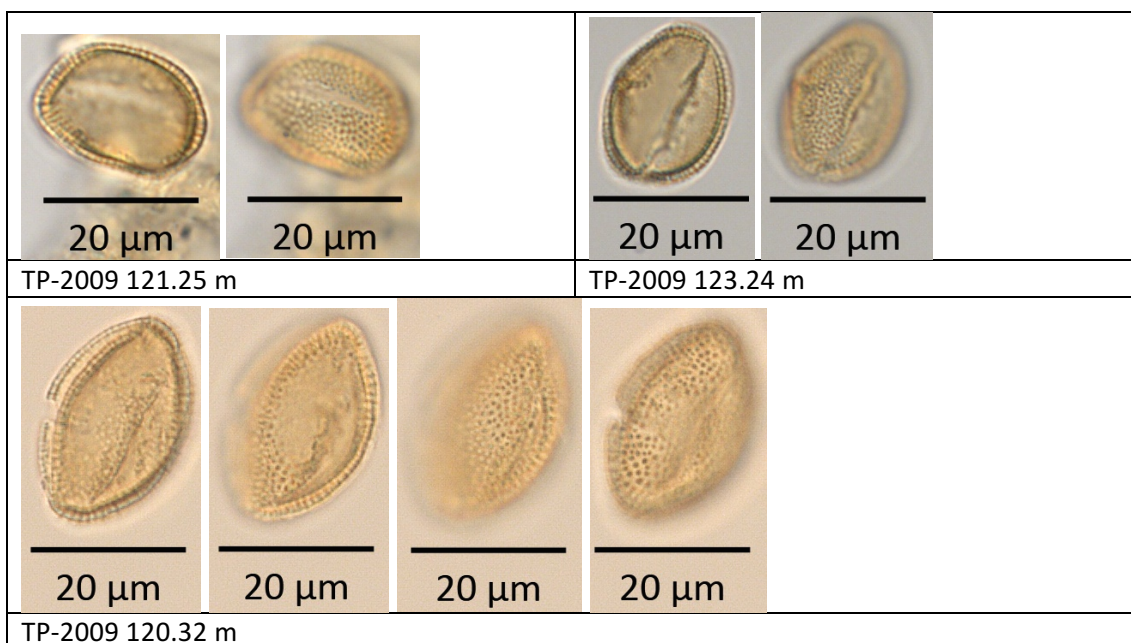
#### General remarks

<b>Plant family</b>	Convolvulaceae
<b>Common names (English/German)</b>	Bindweed, morning glory Winden
<b>Palynomorph group</b>	Non-arboreal pollen
<b>Growth form</b>	Herbaceous perennials to annuals

#### Characteristics

<b>Pollen class</b>	Tricolpate
<b>Pollen grain shape</b>	Sphaeroid-prolate
<b>Pollen grain size</b>	38.9-79.5 µm
<b>Aperture</b>	
<b>Sculpture</b>	Psilate, gemmate
<b>Sporoderm</b>	Exine 3-5 µm, tectum perforatum

### *Cuscuta europaea* type



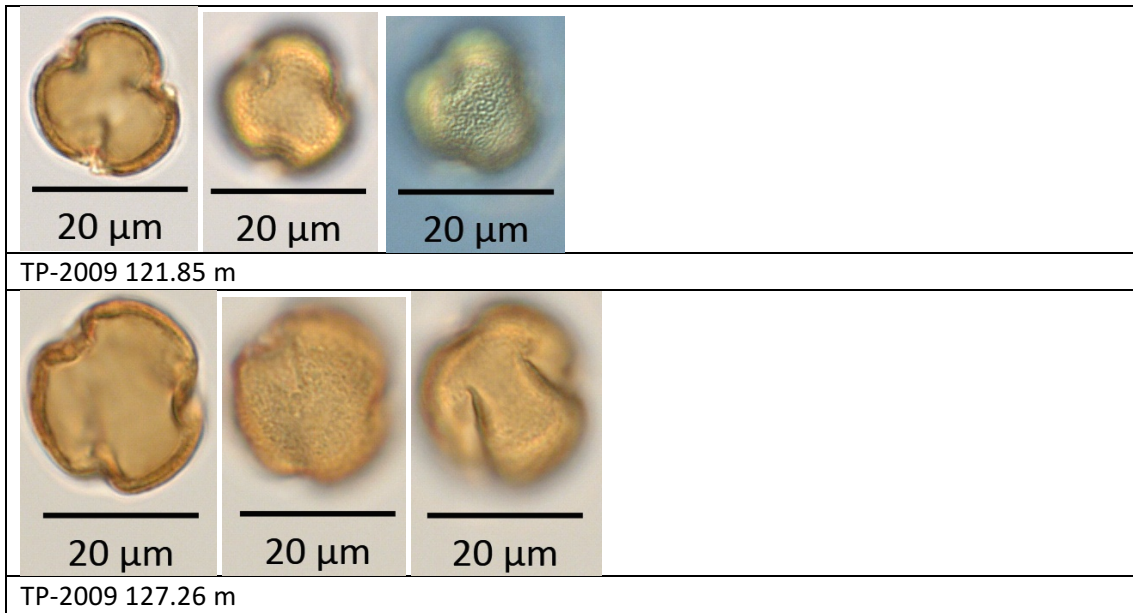
#### General remarks

<b>Plant family</b>	Convolvulaceae
<b>Common names (English/German)</b>	Greater dodder Nessel-Seide
<b>Palynomorph group</b>	Non-arboreal pollen
<b>Growth form</b>	Parasitic creeper, herbaceous annuals

#### Characteristics

<b>Pollen class</b>	Tricolpate ( $\pm$ pericolpate)
<b>Pollen grain shape</b>	Sphaeroid
<b>Pollen grain size</b>	21.2-34.8 $\mu$ m
<b>Aperture</b>	
<b>Sculpture</b>	
<b>Sporoderm</b>	Exine 1.9-2.2(-2.5) $\mu$ m ( $\pm$ polar thicker than eq.) Columellae 0.5-1.0 $\mu$ m, distance 1 $\mu$ m, single standing, regularly distributed, with high contrast (in contrast to <i>Spergularia</i> type)

***Papaver rhoeas* type**



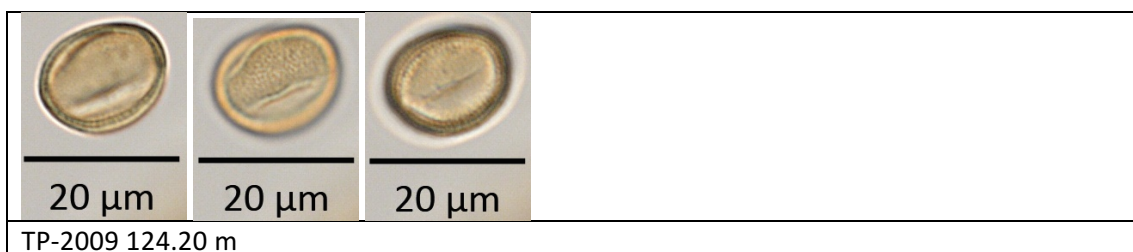
**General remarks**

<b>Plant family</b>	Papaveraceae
<b>Common names (English/German)</b>	Corn poppy Klatschmohn
<b>Palynomorph group</b>	Non-arboreal pollen
<b>Growth form</b>	Herbaceous annuals or biennials

**Characteristics**

<b>Pollen class</b>	Tricolpate
<b>Pollen grain shape</b>	Sphaeroid, prolate
<b>Pollen grain size</b>	20.0-35.0 µm
<b>Aperture</b>	
<b>Sculpture</b>	Scabrate
<b>Sporoderm</b>	Exine 1.5-1.8 µm Columellae thin

***Polycarpon tetraphyllum***



**General remarks**

<b>Plant family</b>	Caryophyllaceae
<b>Common names (English/German)</b>	Fourleaf manyseed Vierblättriges Nagelkraut
<b>Palynomorph group</b>	Non-arboreal pollen
<b>Growth form</b>	Herbaceous annuals

**Characteristics**

<b>Pollen class</b>	Tricolpate
<b>Pollen grain shape</b>	Sphaeroid-prolate
<b>Pollen grain size</b>	14.0-18.0 µm
<b>Aperture</b>	Colpi coarse-granulose
<b>Sculpture</b>	Psilate
<b>Sporoderm</b>	Exine eq. 1.0-1.5 µm, polar 1.5-2.5 µm

***Polygonum alpinum* (= *Persicaria alpina*)**



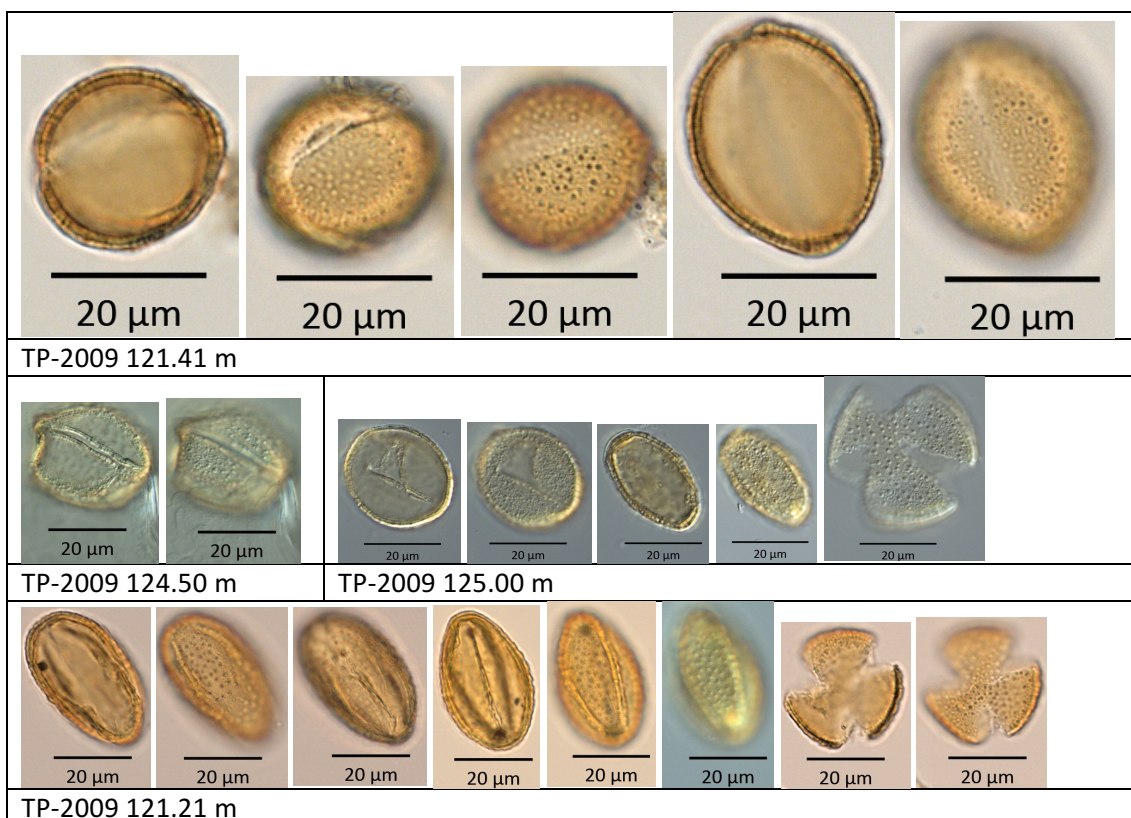
**General remarks**

<b>Plant family</b>	Polygonaceae
<b>Common names (English/German)</b>	Alpine knotweed Alpen-Knöterich
<b>Palynomorph group</b>	Non-arboreal pollen
<b>Growth form</b>	Herbaceous annuals

**Characteristics**

<b>Pollen class</b>	Tricolpate
<b>Pollen grain shape</b>	Sphaeroid
<b>Pollen grain size</b>	25.1-35.4 µm
<b>Aperture</b>	Colpi thin
<b>Sculpture</b>	Psilate
<b>Sporoderm</b>	Exine 2.5-3.5 µm Endexine 0.5-1.0 µm Columellae max. 0.8 µm, distinct

### *Ranunculus acris* type



#### General remarks

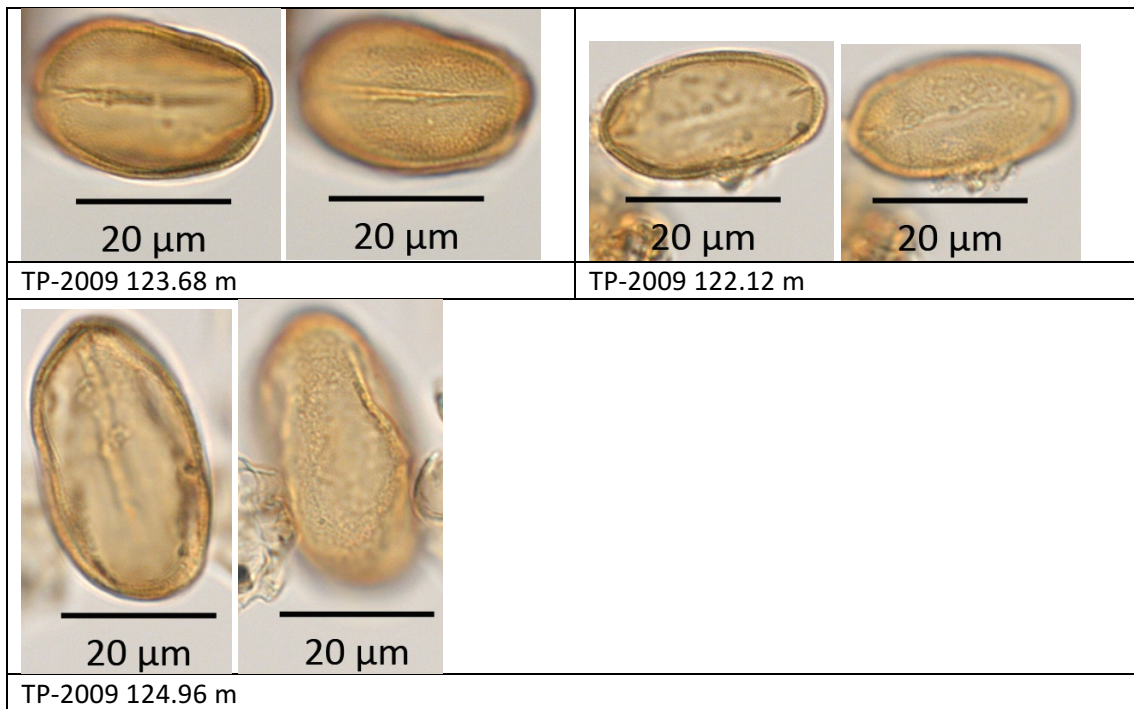
<b>Plant family</b>	Ranunculaceae
<b>Common names (English/German)</b>	Meadow buttercup Scharfer Hahnenfuß
<b>Palynomorph group</b>	Non-arboreal pollen
<b>Growth form</b>	Herbaceous perennials

#### Characteristics

<b>Pollen class</b>	Tricolpate, pericolpate (6 or 12 colpi)
<b>Pollen grain shape</b>	Sphaeroid ( $\pm$ prolate)
<b>Pollen grain size</b>	(15-)25-35(>40) $\mu$ m
<b>Aperture</b>	Colpi broad, max. 5 $\mu$ m
<b>Sculpture</b>	Verrucate, coarse
<b>Sporoderm</b>	Exine 1.7-2.2 $\mu$ m Columellae 1 $\mu$ m
<b>Ecology</b>	High abundances indicate water depth ca. <2.5 m (Harrison & Digerfeldt 1990)



### *Rhinanthus* group



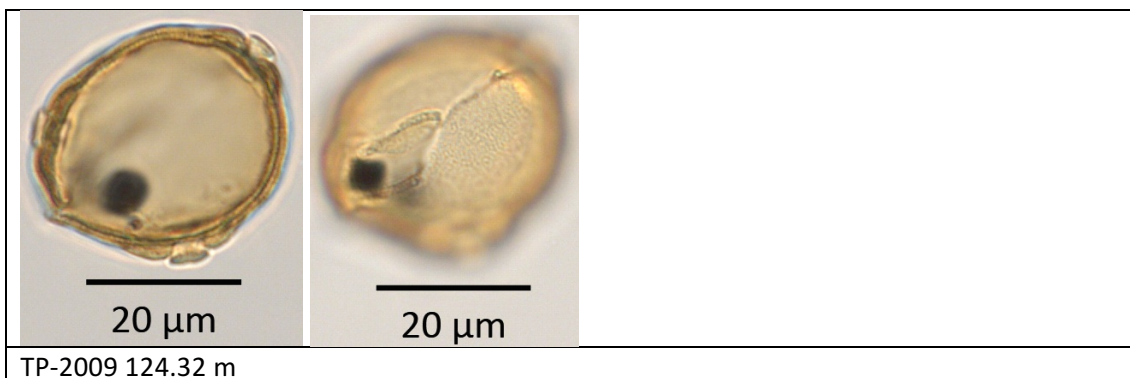
#### General remarks

<b>Plant family</b>	Orobanchaceae
<b>Common names (English/German)</b>	Rattle Klappertöpfe
<b>Palynomorph group</b>	Non-arboreal pollen
<b>Growth form</b>	Semi-parasitic herbaceous annuals

#### Characteristics

<b>Pollen class</b>	Tricolpate
<b>Pollen grain shape</b>	Sphaeroid to prolate, angular
<b>Pollen grain size</b>	19.1-50.6 µm
<b>Aperture</b>	Colpi narrow
<b>Sculpture</b>	Psilate
<b>Sporoderm</b>	Exine 1.0-2.0(-2.5) µm

### *Sanguisorba minor* type





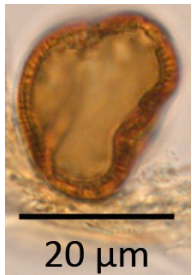


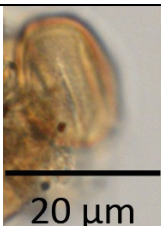
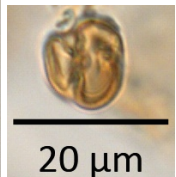
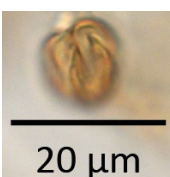
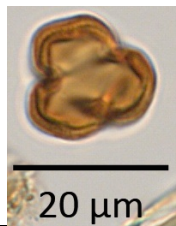

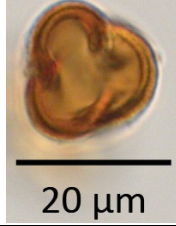



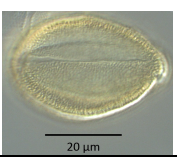
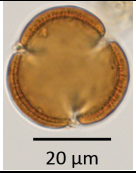

#### General remarks

<b>Plant family</b>	Rosaceae
<b>Common names (English/German)</b>	Salad burnet Kleiner Wiesenkopf
<b>Palynomorph group</b>	Non-arboreal pollen
<b>Growth form</b>	Herbaceous perennials

#### Characteristics

<b>Pollen class</b>	Tricolpate
<b>Pollen grain shape</b>	Sphaeroid-globose
<b>Pollen grain size</b>	24.8-38.0 μm
<b>Aperture</b>	
<b>Sculpture</b>	Psilate
<b>Sporoderm</b>	Exine 1.4-2.6 μm Operculum with 3.5-5.0 μm thick thickening

### *Saxifraga hirculus* type

									
TP-2009 122.26 m					TP-2009 122.20 m				
									
TP-2009 123.52 m									
									
TP-2009 121.97 m					TP-2009 123.60 m				
									
TP-2009 125.00 m					TP-2009 124.20 m				

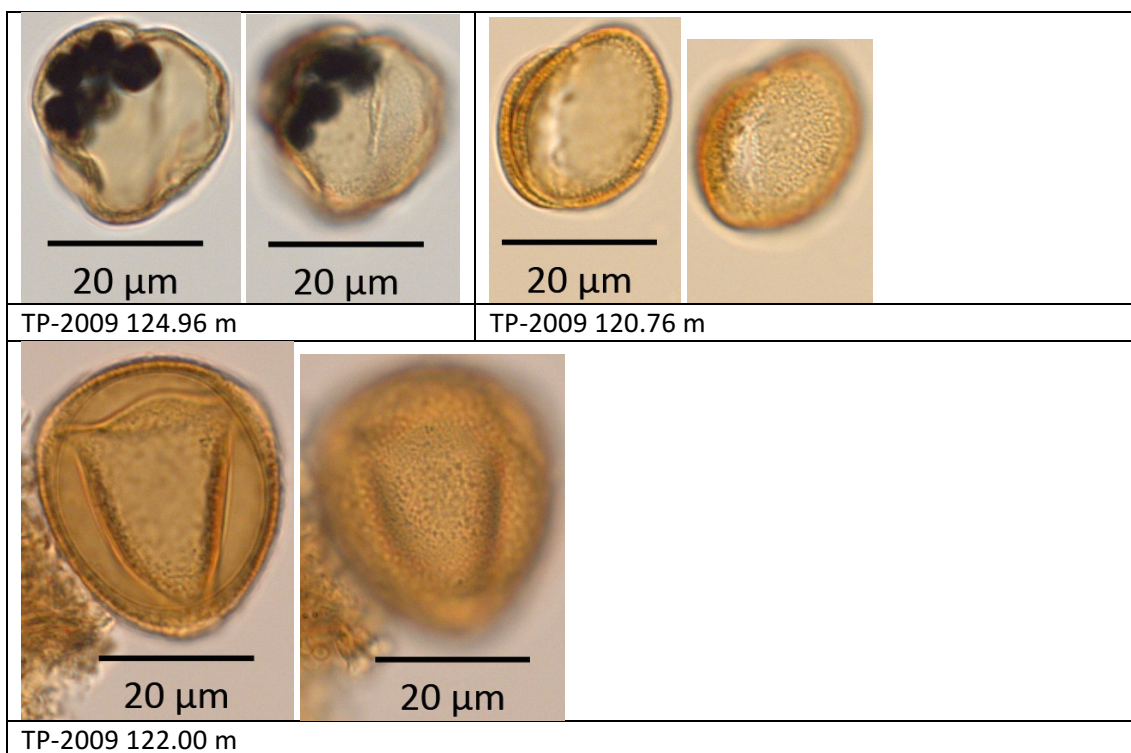
#### General remarks

<b>Plant family</b>	Saxifragaceae
<b>Common names (English/German)</b>	Marsh saxifrage Moor-Steinbrech
<b>Palynomorph group</b>	Non-arboreal pollen
<b>Growth form</b>	Deciduous herbaceous perennials

#### Characteristics

<b>Pollen class</b>	Tricolpate
<b>Pollen grain shape</b>	Sphaeroid to prolate
<b>Pollen grain size</b>	15.8-59.4 µm
<b>Aperture</b>	Colpi granulous
<b>Sculpture</b>	Psilate or scabrate (± striate)
<b>Sporoderm</b>	Exine (0.8-)1.0-2.0(-2.5), polar thicker than eq. Tectum thicker than endexine

### *Spergularia* type

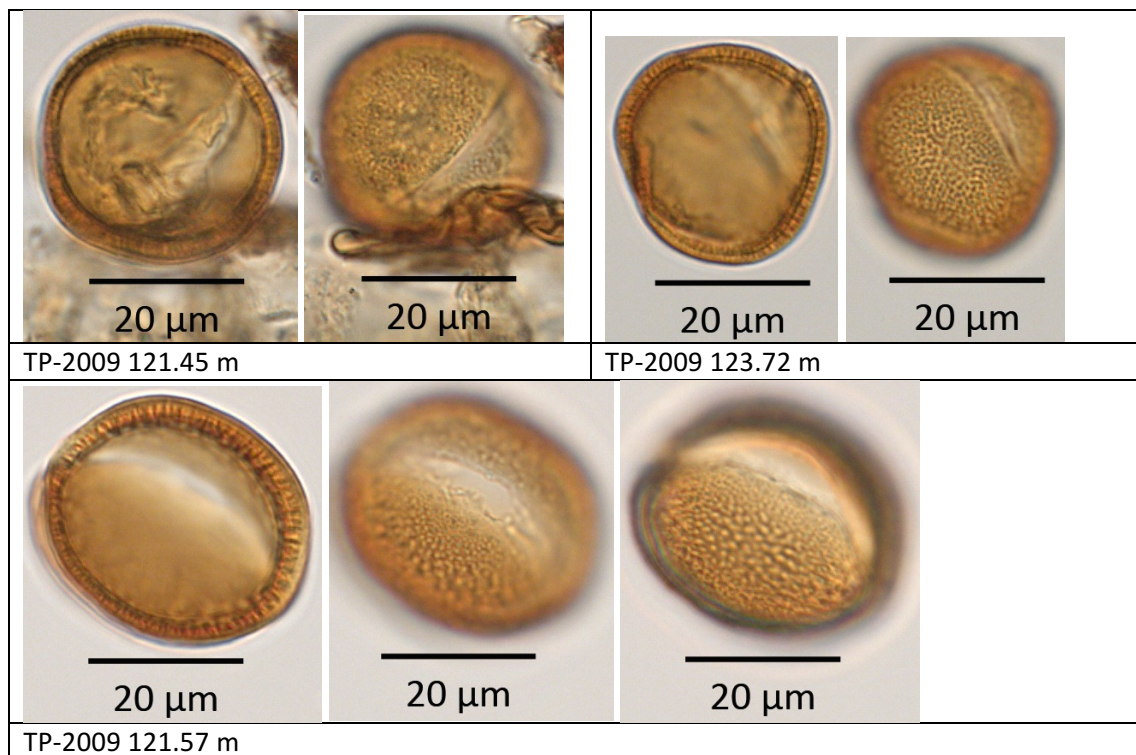


#### General remarks

<b>Plant family</b>	Caryophyllaceae
<b>Common names (English/German)</b>	Spurrys Schuppenmieren
<b>Palynomorph group</b>	Non-arboreal pollen
<b>Growth form</b>	Herbaceous perennials or annuals

#### Characteristics

<b>Pollen class</b>	Tricolpate ( $\pm$ pericolpate, tetracolpate)
<b>Pollen grain shape</b>	Sphaeroid
<b>Pollen grain size</b>	17.0-31.2 $\mu\text{m}$
<b>Aperture</b>	Colpi 1.5-2.0 $\mu\text{m}$ broad
<b>Sculpture</b>	Psilate, slightly scabrate
<b>Sporoderm</b>	Exine (1.7-)1.8-2.0(-2.2) $\mu\text{m}$ , tectum perforatum

*Valerianella***General remarks**

<b>Plant family</b>	Caprifoliaceae
<b>Common names (English/German)</b>	Corn salad Feldsalat
<b>Palynomorph group</b>	Non-arboreal pollen
<b>Growth form</b>	Herbaceous annuals

**Characteristics**

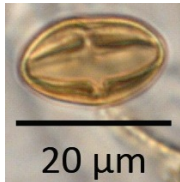
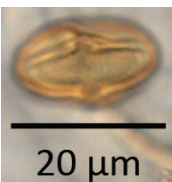



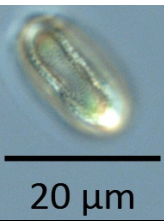






<b>Pollen class</b>	Tricolpate
<b>Pollen grain shape</b>	Sphaeroid-prolate
<b>Pollen grain size</b>	29.0-47.5 µm
<b>Aperture</b>	Colpi broad, 3-6(-7.5) µm, coarse
<b>Sculpture</b>	Psilate
<b>Sporoderm</b>	Exine (3.5)-4.0-5.0(-5.5) Columellae distinct

# Tricolporatae

psilate, scabrate, verrucate, microverrucate



**Castanea**

 			 		
TP-2009 125.60 m			TP-2009 123.04 m		
  			 		
TP-2009 124.00 m			TP-2009 121.41 m		
  					
TP-2009 125.96 m					

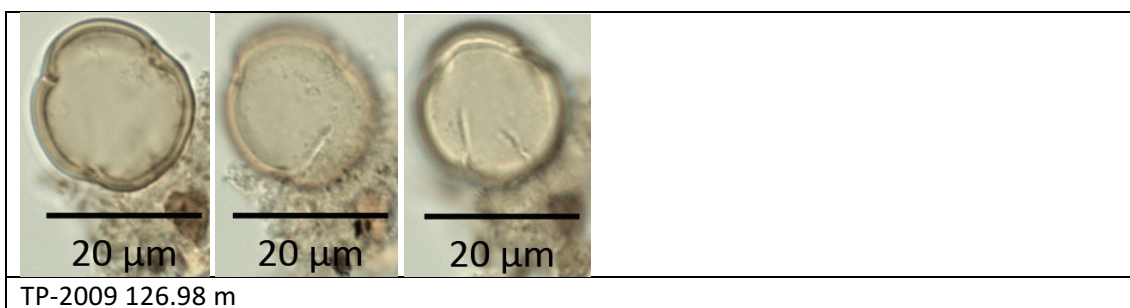
**General remarks**

<b>Plant family</b>	Fagaceae
<b>Common names (English/German)</b>	Chestnut Kastanien
<b>Palynomorph group</b>	Arboreal pollen
<b>Growth form</b>	Deciduous tree (± shrub)

**Characteristics**

<b>Pollen class</b>	Tricolporate
<b>Pollen grain shape</b>	Prolate (± sphaeroid), eq. elliptic, polar rounded
<b>Pollen grain size</b>	12.0-20.4 µm
<b>Aperture</b>	Colpi transversales, 3-5 x 1-2 µm (± rounded pores) Colpi recessed
<b>Sculpture</b>	Psilate to slightly scabrate, not microreticulate as <i>Hypericum perforatum</i> type
<b>Sporoderm</b>	Exine 1.0-1.5 µm Columellae indistinct

## *Eucommia ulmoides*



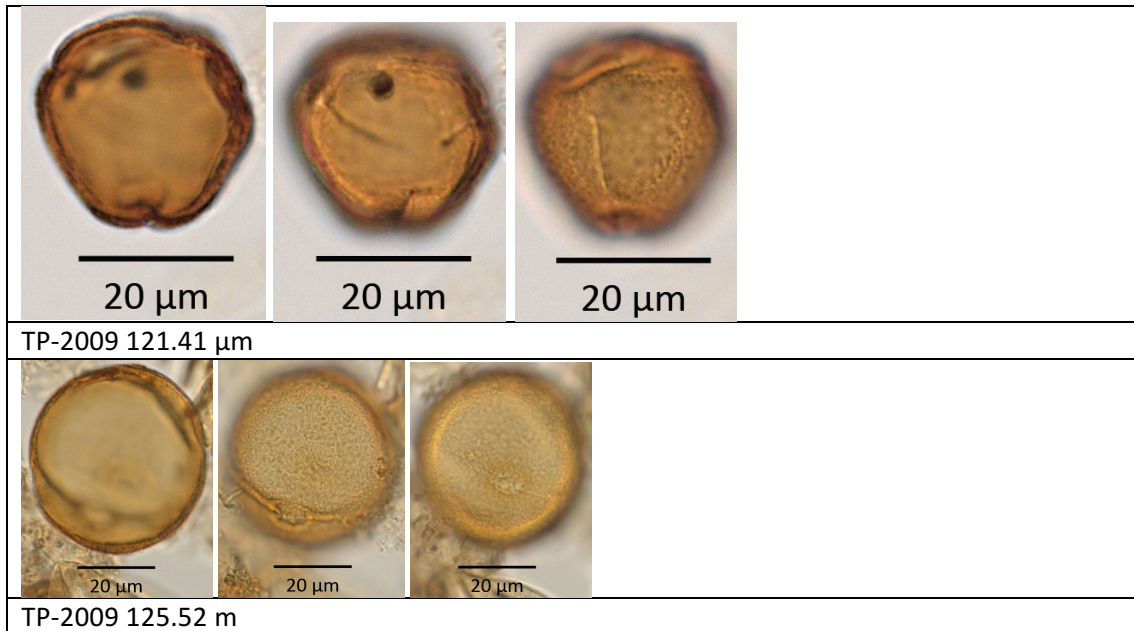
### General remarks

<b>Plant family</b>	Eucommiaceae
<b>Common names (English/German)</b>	Gutta-percha tree, Chinese rubber tree Guttaperchabaum, Gummiulme
<b>Palynomorph group</b>	Arboreal pollen
<b>Growth form</b>	Deciduous tree

### Characteristics

<b>Pollen class</b>	Tricolporate
<b>Pollen grain shape</b>	Sphaeroid
<b>Pollen grain size</b>	32.8-39.5 µm
<b>Aperture</b>	Pori circular, 6-8 µm, or thin and meridional elongated Colpi with different length, one shorter than the others, colpi inclined, bent or asymmetrical Intercolpium margins recessed
<b>Sculpture</b>	Psilate
<b>Sporoderm</b>	Exine 1.8-2.2 µm, two-layered, inner 1 µm, thicker than outer layer Columellae not visible

## *Fagus*



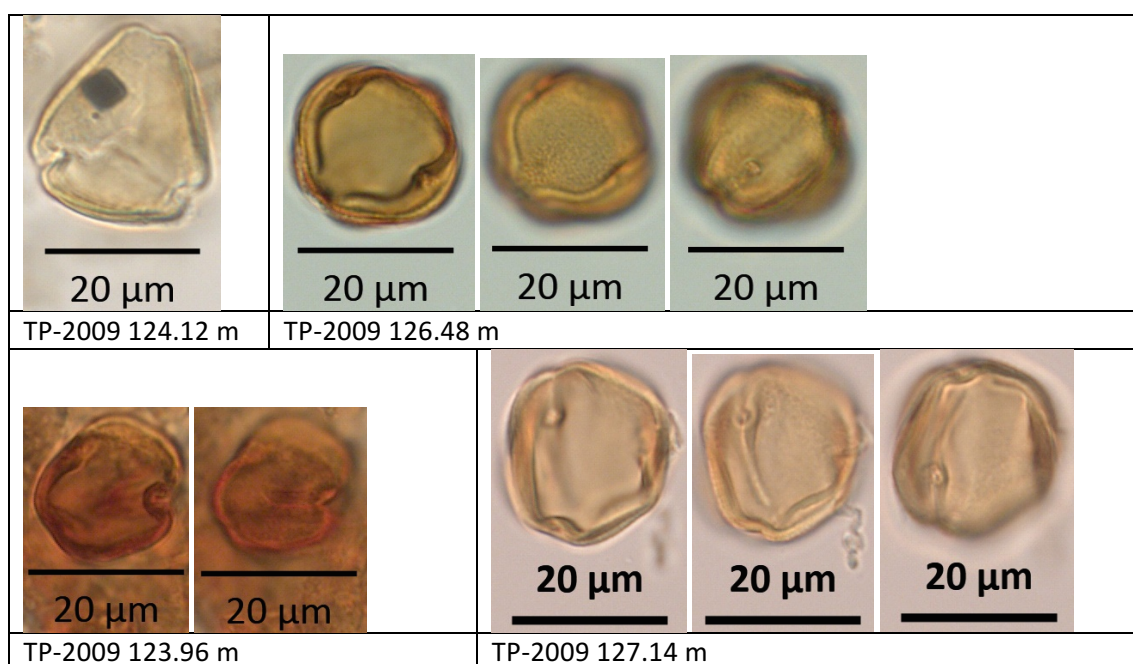
### General remarks

<b>Plant family</b>	Fagaceae
<b>Common names (English/German)</b>	Beech Buchen
<b>Palynomorph group</b>	Arboreal pollen
<b>Growth form</b>	Deciduous tree (± shrub)

### Characteristics

<b>Pollen class</b>	Tricolporate
<b>Pollen grain shape</b>	Sphaeroid, mostly globose, polar circular or slightly triangular and angulaperturate
<b>Pollen grain size</b>	28.3-42.8 µm
<b>Aperture</b>	Pori rounded or meridional elongated, 5-7 µm Colpi max. 2 µm broad, intercolpium margins recessed
<b>Sculpture</b>	Scabrate
<b>Sporoderm</b>	Exine 1.5-2.0 µm Columellae indistinct
<b>Ecology</b>	Requires warm conditions and higher moisture availability (Christanis 1983) Warmer and drier summers impede the expansion of <i>Fagus</i> and <i>Abies</i> , together with <i>Picea</i> most drought-sensitive trees, maybe also favoured by a decrease of late-frost events (Tinner & Lotter 2006)

***Frangula (= Rhamnus)***



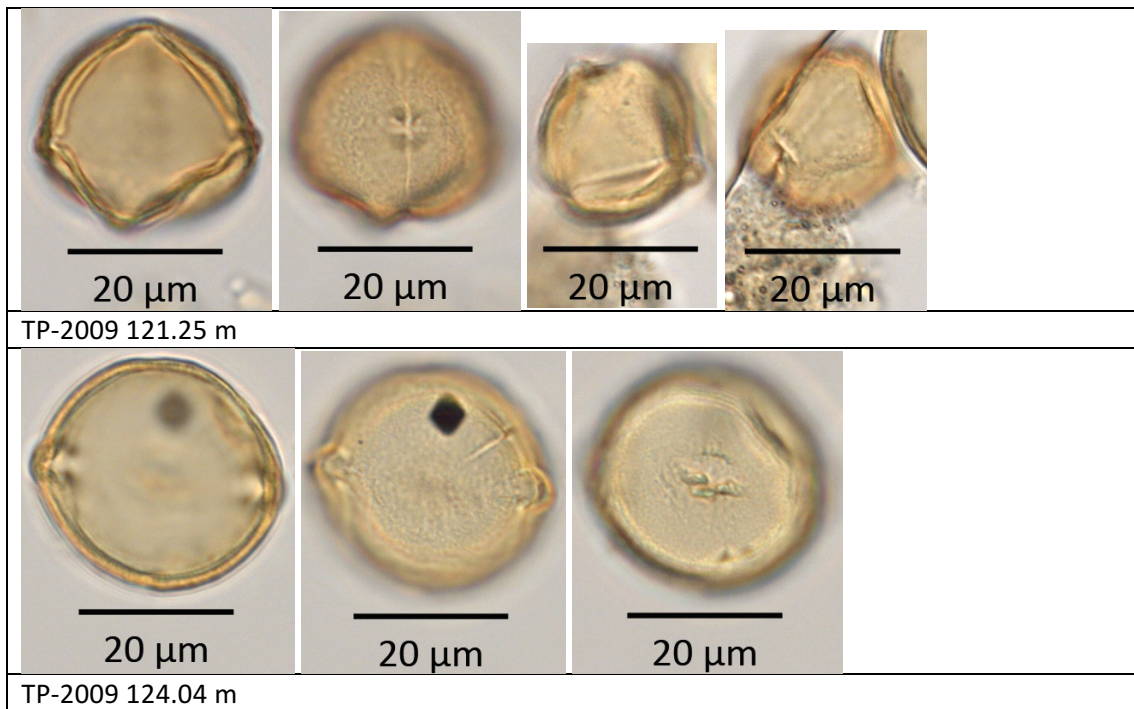
**General remarks**

<b>Plant family</b>	Rhamnaceae
<b>Common names (English/German)</b>	Buckthorns Faulbäume
<b>Palynomorph group</b>	Arboreal pollen
<b>Growth form</b>	Deciduous shrub (± tree)

**Characteristics**

<b>Pollen class</b>	Tricolporate
<b>Pollen grain shape</b>	Sphaeroid, eq. rhomboid to elliptic (± slightly apiculate)
<b>Pollen grain size</b>	12.4-28.3 µm
<b>Aperture</b>	Pori circular or slit-shaped, 1.5-2 µm or 1.5 x 4 µm Colpi with flattened intercolpi
<b>Sculpture</b>	Reticulate, brochi 1-2(-4) µm
<b>Sporoderm</b>	Exine 1.1-1.4 µm

## *Hippophaë*



### General remarks

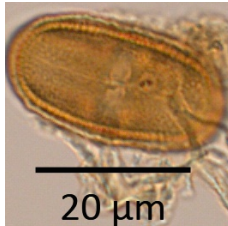
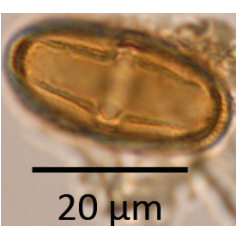

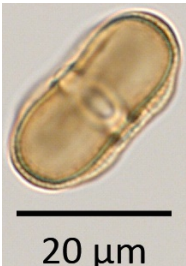
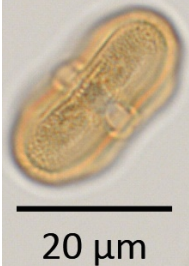
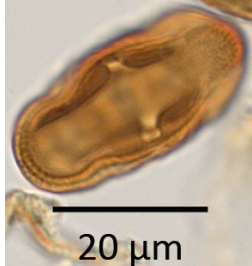
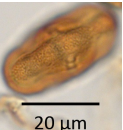

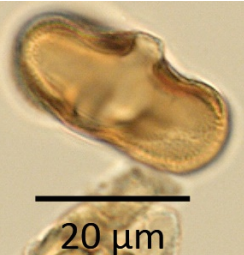
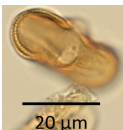
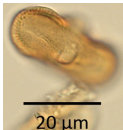

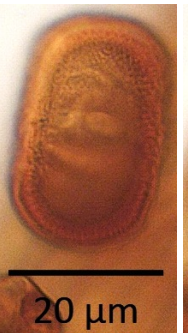



<b>Plant family</b>	Elaeagnaceae
<b>Common names (English/German)</b>	Sea-buckthorns Sanddorne
<b>Palynomorph group</b>	Arboreal pollen
<b>Growth form</b>	Deciduous shrub (± tree)

### Characteristics

<b>Pollen class</b>	Tricolporate
<b>Pollen grain shape</b>	Sphaeroid to slightly rhomboid, polar triangular
<b>Pollen grain size</b>	24.3-34.5 µm
<b>Aperture</b>	Pori 3 µm, rounded or transversal elongated, 3 µm high Colpi thin and very long
<b>Sculpture</b>	Scabrate to slightly verrucate
<b>Sporoderm</b>	Exine 1.5-1.8 µm
<b>Ecology</b>	Pioneer plant, that grows at the onset of a glacial and grows in low nutrient soils



## Apiaceae p.p.

  			 	
TP-2009 122.20 m			TP-2009 121.53 m	
  			  	
TP-2009 122.96 m			<i>Bifora</i> type, TP-2009 121.00 m	
  			 	
TP-2009 120.60 m			TP-2009 121.57 m	

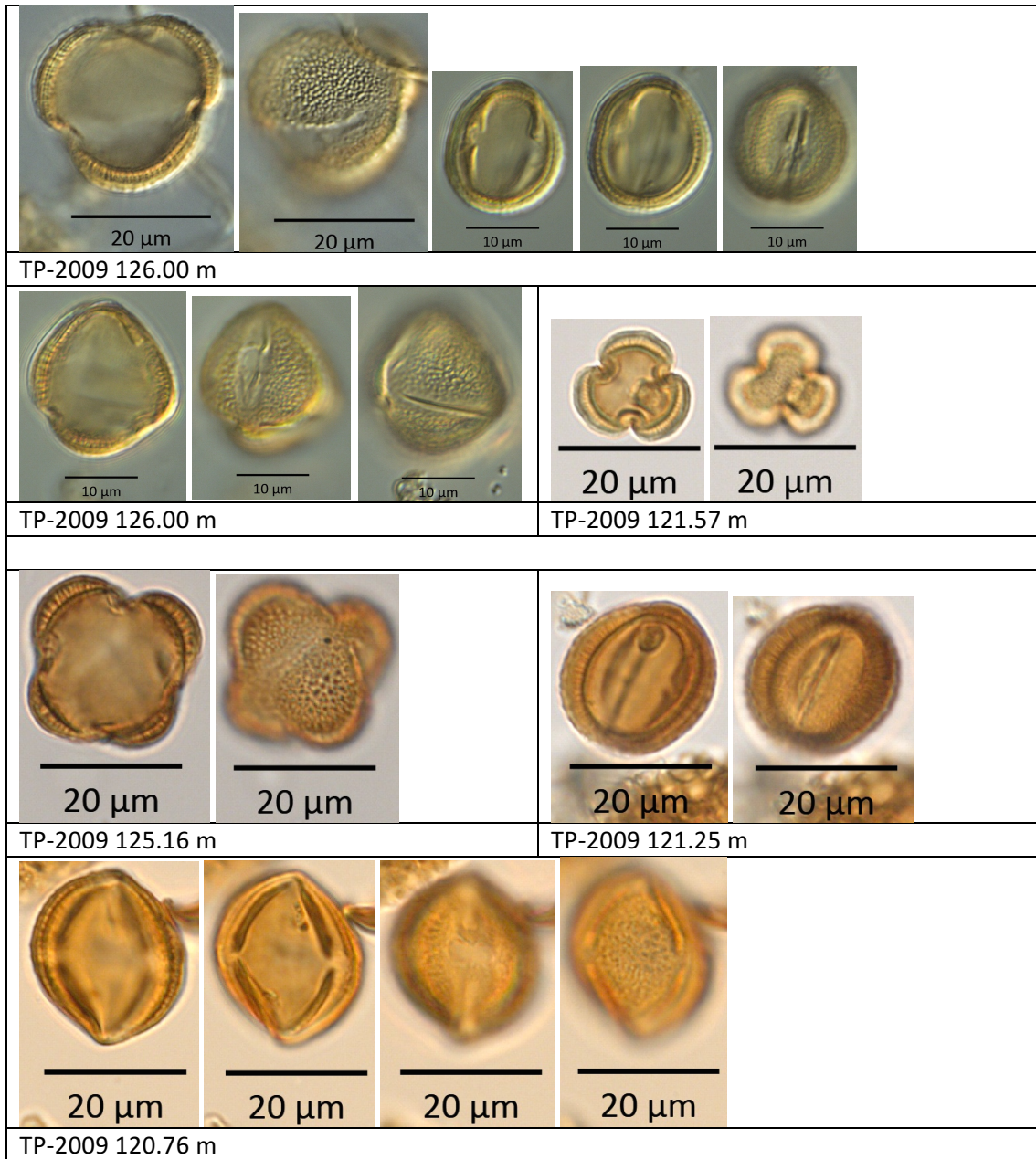
### General remarks

<b>Plant family</b>	Apiaceae
<b>Common names (English/German)</b>	Celery, carrot or parsley family Doldenblütler
<b>Palynomorph group</b>	Non-arboreal pollen
<b>Growth form</b>	Herbaceous perennials (mostly)

### Characteristics

<b>Pollen class</b>	Tricolporate
<b>Pollen grain shape</b>	Prolate to perprolate, rod-shaped
<b>Pollen grain size</b>	
<b>Aperture</b>	Pori large, circular, elliptic or rectangular; Colpi thin
<b>Sculpture</b>	Psilate
<b>Sporoderm</b>	Exine tectate
<b>Remarks</b>	<b>Characteristics for Apiaceae:</b> OC = outer contour, IC = inner contour IC-side = intercolpium side, C-side = colpus side

## *Artemisia*



### General remarks

<b>Plant family</b>	Asteraceae
<b>Common names (English/German)</b>	Mugwort, wormwood, sagebrush Beifuß, Wermut, Stabwurz, Edelraute
<b>Palynomorph group</b>	Non-arboreal pollen
<b>Growth form</b>	Herbaceous perennials (mostly)

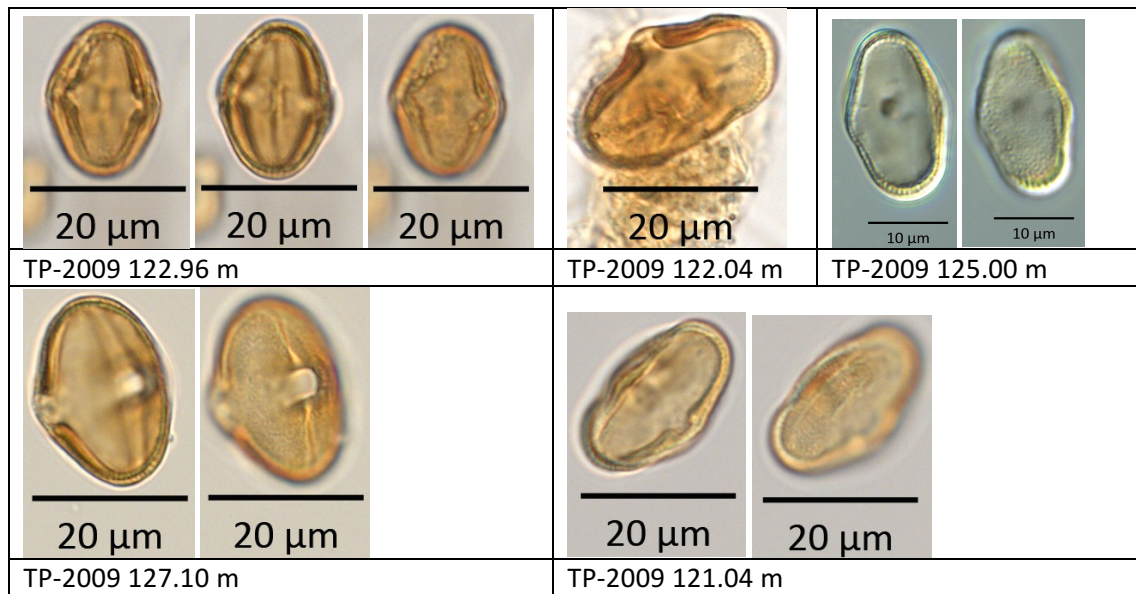
### Characteristics

<b>Pollen class</b>	Tricolporate, tricolporoidate ( $\pm$ tricolpate, pericolpate, pericolporate)
<b>Pollen grain shape</b>	Sphaeroid-prolate
<b>Pollen grain size</b>	15.6-35.0 $\mu$ m
<b>Aperture</b>	Colpi recessed, colpi transversales common



<b>sSculpture</b>	Microechinate
<b>Sporoderm</b>	Exine 2.0-5.2 $\mu\text{m}$ Tectum >1.5 $\mu\text{m}$ , inner distinct refractive, outer slightly refractive layer
<b>Ecology</b>	Steppe element indicating cold and/or dry steppe conditions; requires more moisture availability than Chenopodiaceae and less than Cyperaceae and Poaceae (El-Moslimany 1990, Li et al. 2010, Zhao et al. 2008)

## *Bupleurum*



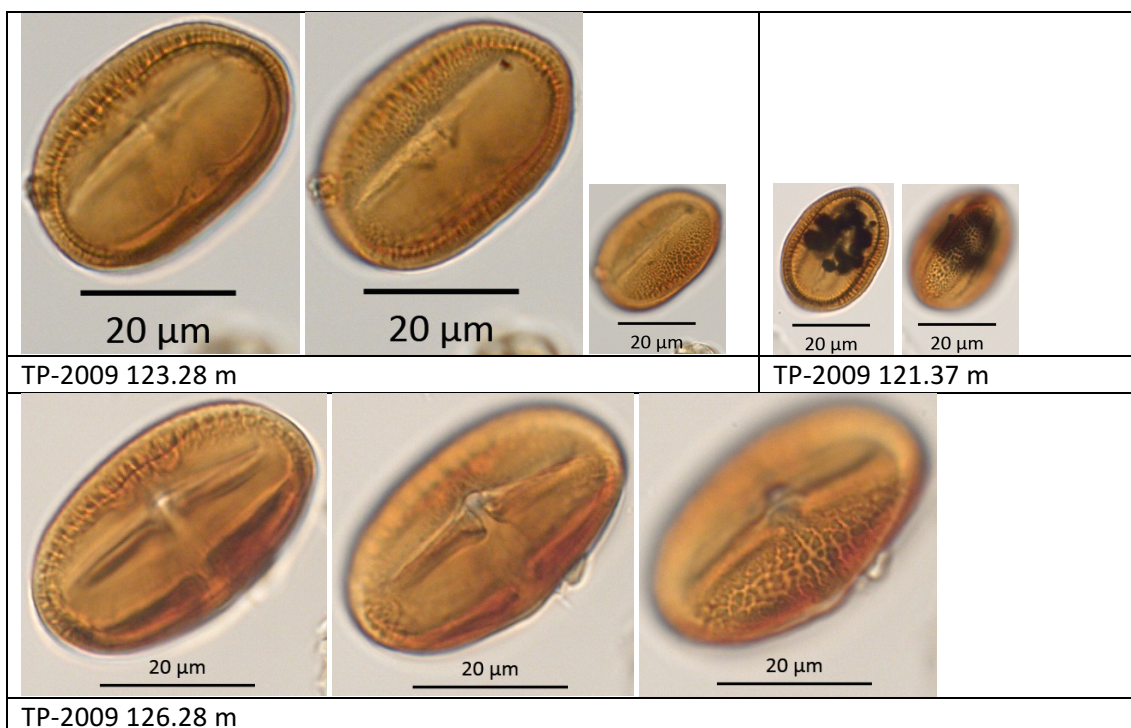
### General remarks

<b>Plant family</b>	Apiaceae
<b>Common names (English/German)</b>	Hare's ear Hasenohren
<b>Palynomorph group</b>	Non-arboreal pollen
<b>Growth form</b>	Herbaceous perennials (mostly)

### Characteristics

<b>Pollen class</b>	Tricolporate (± syncolpate)
<b>Pollen grain shape</b>	Rhomboid-angular OC asymmetric; IC-side slightly convex, C-side rhomboid IC convex
<b>Pollen grain size</b>	17.0-35.5 µm
<b>Aperture</b>	
<b>Sculpture</b>	Psilate
<b>Sporoderm</b>	Exine eq. 1-2 µm, polar 1.1-2.5 µm

*Centaurea cyanus*

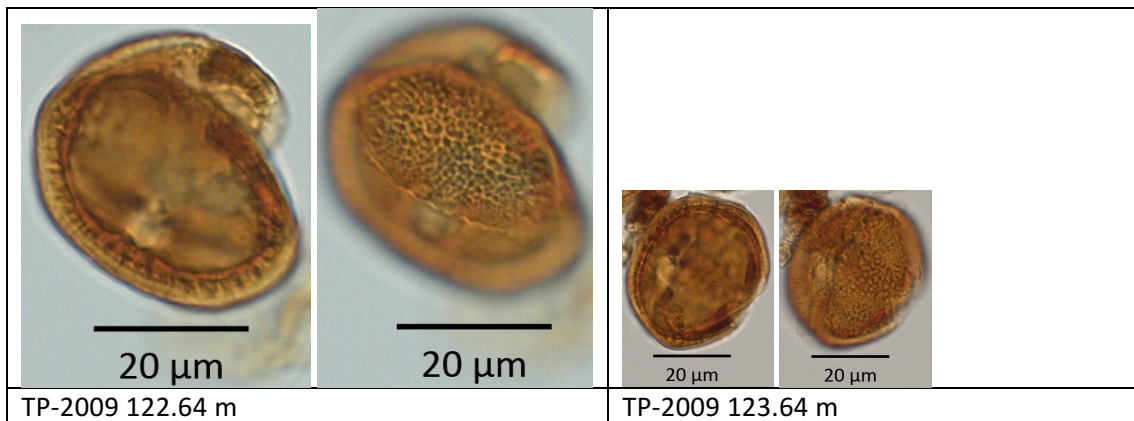


**General remarks**

<b>Plant family</b>	Asteraceae
<b>Common names (English/German)</b>	Cornflower Kornblume
<b>Palynomorph group</b>	Non-arboreal pollen
<b>Growth form</b>	Herbaceous annuals

**Characteristics**

<b>Pollen class</b>	Tricolporate
<b>Pollen grain shape</b>	Prolate, eq. ± parallel margins, polar triangular, planaperturate
<b>Pollen grain size</b>	31.2-41.8 µm
<b>Aperture</b>	Pores distinct eq. elongated, with costae Intercolpi with margins
<b>Sculpture</b>	Slightly scabrate
<b>Sporoderm</b>	Exine without costae 5-7 µm Columellae: inner max. 3 µm long, 1-2 µm thick; outer two-layered

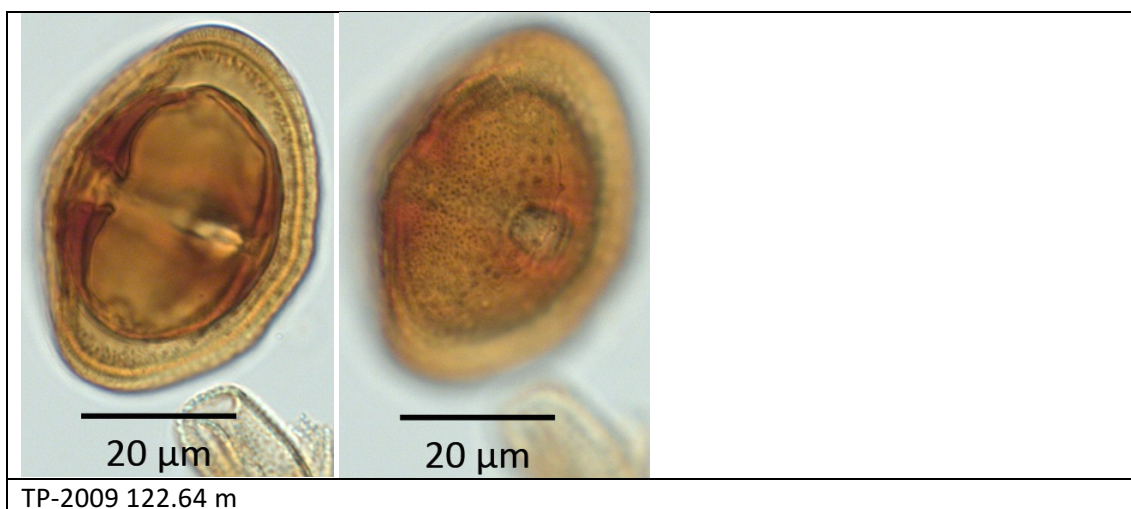
***Centaurea montana* type****General remarks**

<b>Plant family</b>	Asteraceae
<b>Common names (English/German)</b>	Perennial cornflower Berg-Flockenblume
<b>Palynomorph group</b>	Non-arboreal pollen
<b>Growth form</b>	Indiciduous herbaceous perennials

**Characteristics**

<b>Pollen class</b>	Tricolporate
<b>Pollen grain shape</b>	Sphaeroid to prolate, elliptic
<b>Pollen grain size</b>	50.5-62.7 µm
<b>Aperture</b>	Colpi transversales, 7-9 x 12-15 µm, with slightly or without costae
<b>Sculpture</b>	Slightly scabrate
<b>Sporoderm</b>	Exine eq. 6-8 µm, polar 4.5-7 µm Columellae: outer radial striated, inner coarse, proximal max. 1.5 µm thick, distal branched

### *Centaurea scabiosa* type



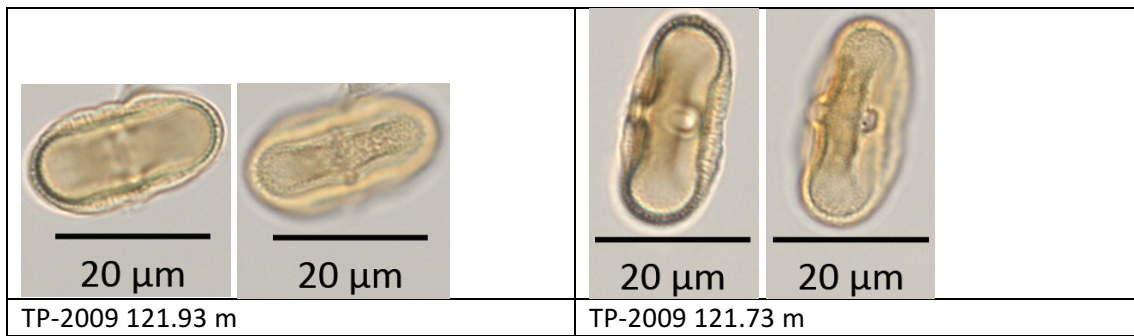
#### General remarks

<b>Plant family</b>	Asteraceae
<b>Common names (English/German)</b>	Greater Knapweed Skabiosen-Flockenblume
<b>Palynomorph group</b>	Non-arboreal pollen
<b>Growth form</b>	Herbaceous perennials

#### Characteristics

<b>Pollen class</b>	Tricolporate
<b>Pollen grain shape</b>	Sphaeroid, eq. rhomboid, polar rounded ( $\pm$ slightly triangular)
<b>Pollen grain size</b>	44.5-59.5 $\mu\text{m}$
<b>Aperture</b>	Colpi transversales, 10 x 20 $\mu\text{m}$ , without costae
<b>Sculpture</b>	Scabrate
<b>Sporoderm</b>	Exine eq. 6-8 $\mu\text{m}$ , polar 6-10 $\mu\text{m}$ Columellae: outer radial striated, two-layered, inner rudimentarily

### Conium type



#### General remarks

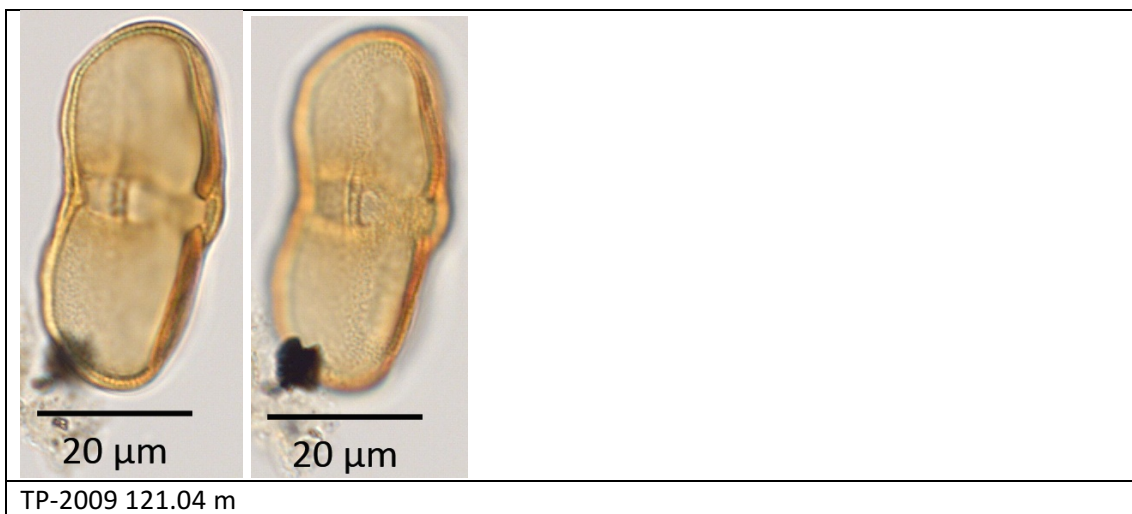
Plant family	Apiaceae
Common names (English/German)	Hemlock Schierling
Palynomorph group	Non-arboreal pollen
Growth form	Herbaceous biennial

#### Characteristics

Pollen class	Tricolporate
Pollen grain shape	Prolate to perprolate, eq. interangular to circular OC linear or eq. concave, C-side linear IC turned into or recessed, $\pm$ linear
Pollen grain size	26.8-48.8 $\mu\text{m}$
Aperture	
Sculpture	Psilate
Sporoderm	Exine eq. 3.5-7.0 $\mu\text{m}$ , polar 0.7-1.0 $\mu\text{m}$



## *Eryngium*

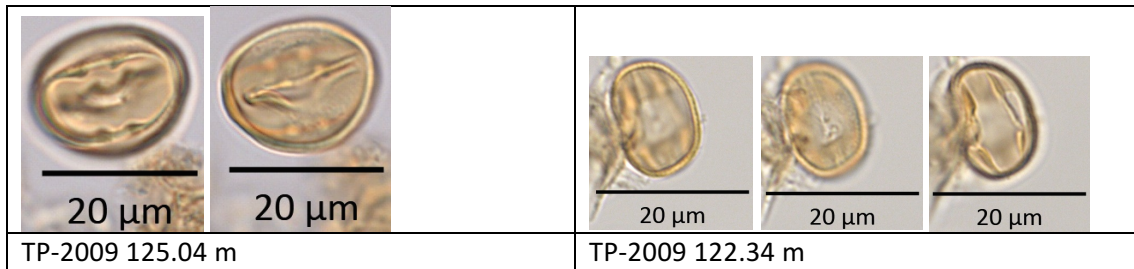


### General remarks

<b>Plant family</b>	Apiaceae
<b>Common names (English/German)</b>	Eryngo, sea holly Mannstreu
<b>Palynomorph group</b>	Non-arboreal pollen
<b>Growth form</b>	Herbaceous perennials to annuals

### Characteristics

<b>Pollen class</b>	Tricolporate
<b>Pollen grain shape</b>	Prolate to perprolate IC-side concave, C-side convex
<b>Pollen grain size</b>	39.8-65.0 µm
<b>Aperture</b>	
<b>Sculpture</b>	Psilate
<b>Sporoderm</b>	Exine 1.5-2.5 µm

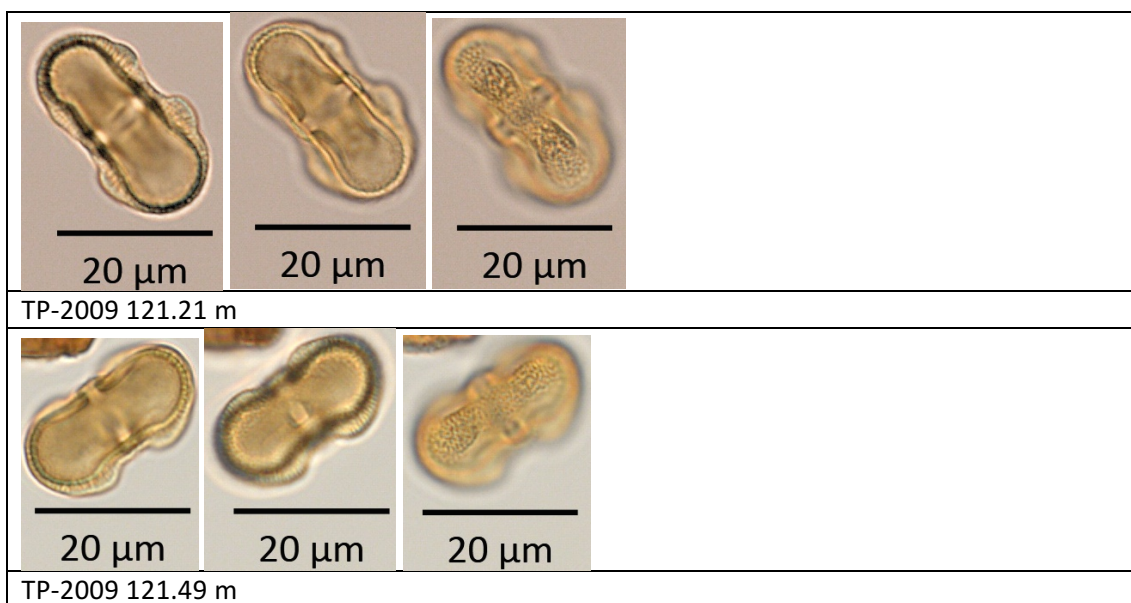
**Lotus type****General remarks**

<b>Plant family</b>	Fabaceae
<b>Common names (English/German)</b>	Bird's-foot trefoil Hornklee
<b>Palynomorph group</b>	Non-arboreal pollen
<b>Growth form</b>	Herbaceous perennials

**Characteristics**

<b>Pollen class</b>	Tricolporate
<b>Pollen grain shape</b>	Sphaeroid-prolate, elliptic, parallel sides
<b>Pollen grain size</b>	13.1-27.5 µm
<b>Aperture</b>	Pori 2-35 x 3-7 µm, oval, spindle-shaped or butterfly-like, partly with costae Colpi with costae
<b>Sculpture</b>	Psilate, large grains slightly microreticulate
<b>Sporoderm</b>	Exine 0.5-1.0 µm

***Pimpinella major/saxifraga* type**



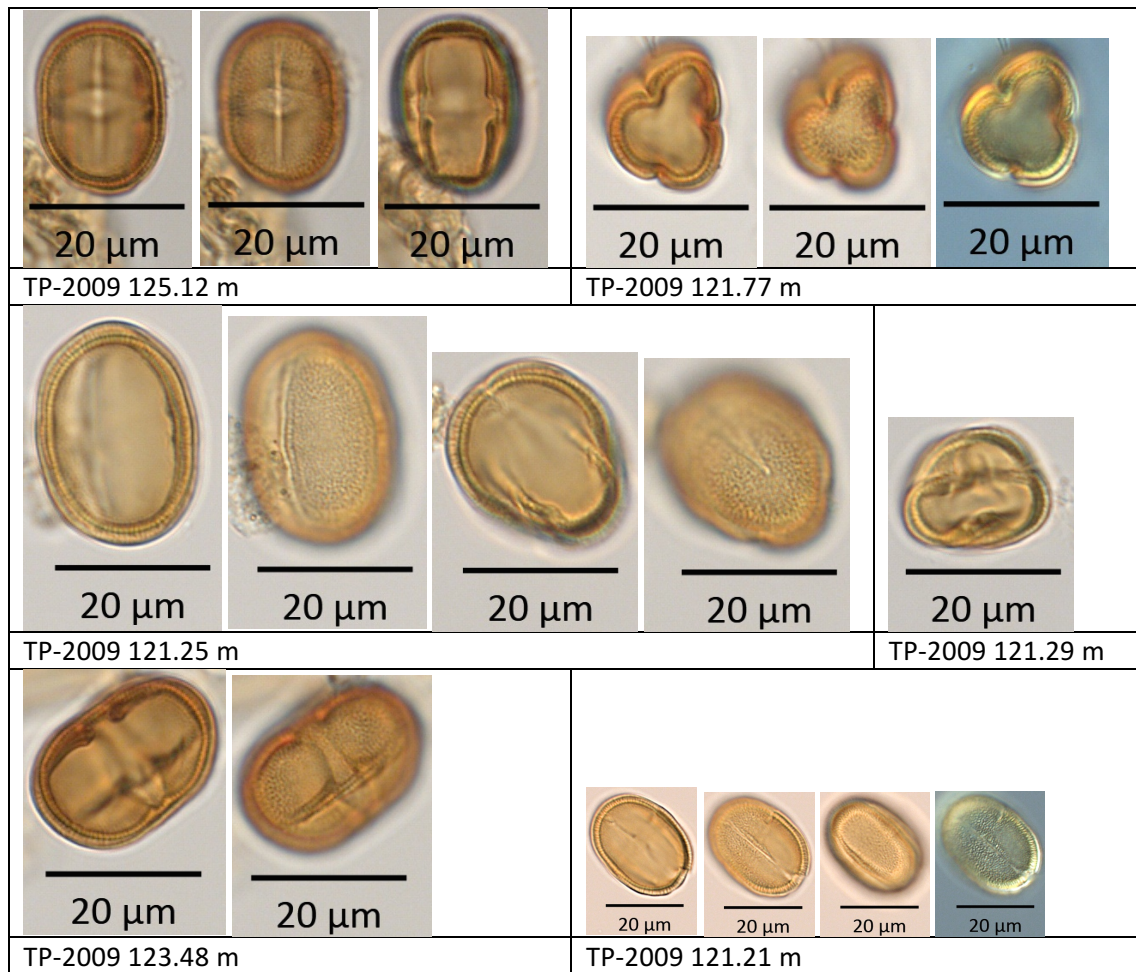
**General remarks**

<b>Plant family</b>	Apiaceae
<b>Common names (English/German)</b>	Greater burnet-saxifrage Große Bibernelle
<b>Palynomorph group</b>	Non-arboreal pollen
<b>Growth form</b>	Herbaceous perennials

**Characteristics**

<b>Pollen class</b>	Tricolporate
<b>Pollen grain shape</b>	Prolate to perprolate, interangular
<b>Pollen grain size</b>	30.0-47.8 µm
<b>Aperture</b>	Pori rounded or square, bubble-like bulged Intercolpium wing-like
<b>Sculpture</b>	Psilate
<b>Sporoderm</b>	Exine eq. 2.0-3.3 µm, subeq. 3.4-5.8 µm, polar 1.7-2.5 µm

### *Polygonum aviculare* type



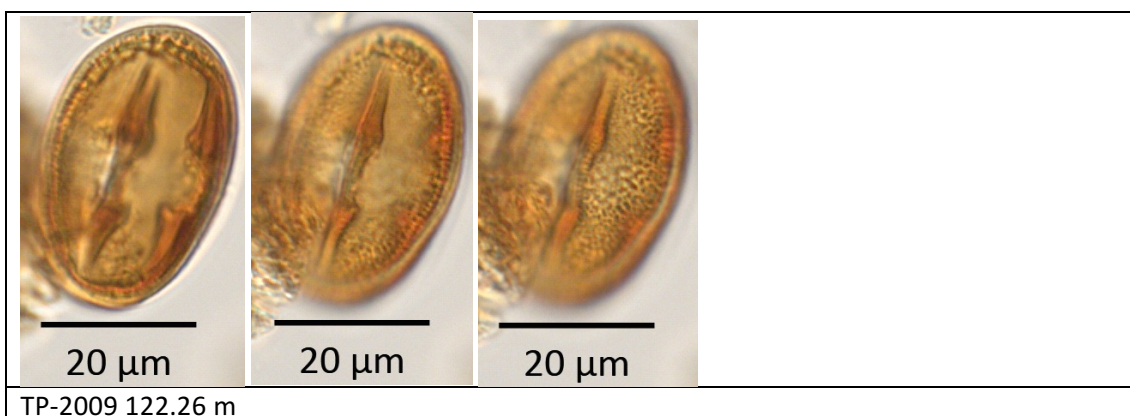
#### General remarks

<b>Plant family</b>	Polygonaceae
<b>Common names (English/German)</b>	Common knotgrass Vogelknöterich
<b>Palynomorph group</b>	Non-arboreal pollen
<b>Growth form</b>	Herbaceous annuals

#### Characteristics

<b>Pollen class</b>	Tricolporate (± tetracolporate)
<b>Pollen grain shape</b>	Sphaeroid to prolate
<b>Pollen grain size</b>	19.5-37.5 µm
<b>Aperture</b>	Colpi transversales, with costae
<b>Sculpture</b>	Psilate
<b>Sporoderm</b>	Exine 2.0-3.2 µm, subpolar thickest Columellae distinct

***Polygonum bistorta* type (= *Bistorta officinalis*)**



TP-2009 122.26 m

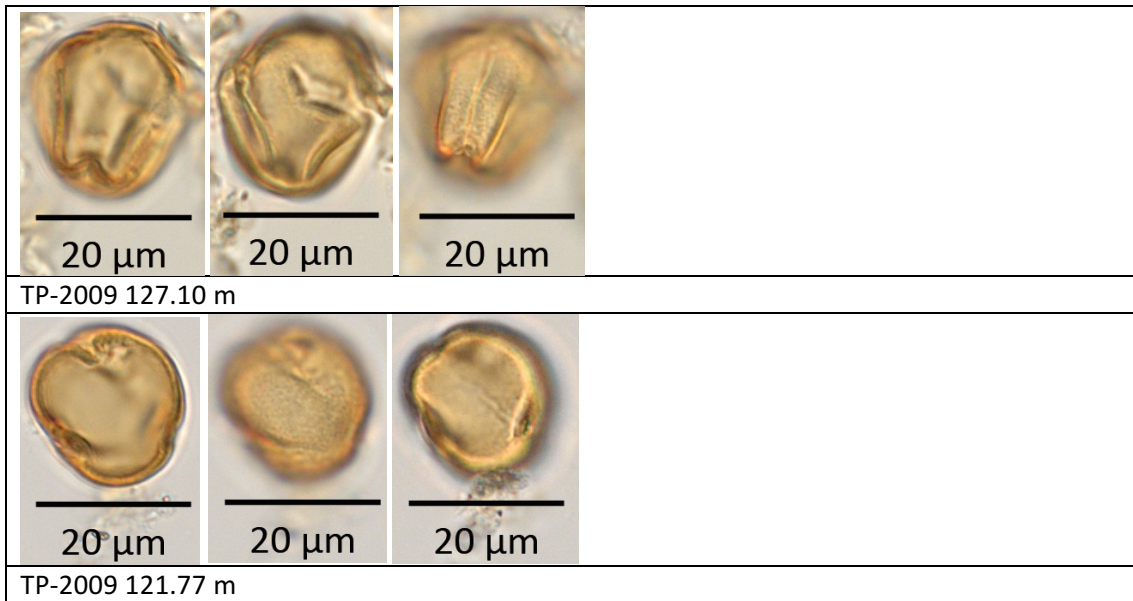
**General remarks**

<b>Plant family</b>	Polygonaceae
<b>Common names (English/German)</b>	European bistort Schlangen-Knöterich
<b>Palynomorph group</b>	Non-arboreal pollen
<b>Growth form</b>	Herbaceous perennials

**Characteristics**

<b>Pollen class</b>	Tricolporate
<b>Pollen grain shape</b>	Prolate, polar triangular, planaperturate
<b>Pollen grain size</b>	45.5-75.4 µm
<b>Aperture</b>	Pori 7-12 µm, circular or meridional elongated
<b>Sculpture</b>	Psilate
<b>Sporoderm</b>	Exine eq. 1.8-2.5 µm, polar 3.8-5.5 µm, polar and subpolar twice as thick as eq. Columellae eq. short and indistinct, polar and subpolar long, thick, distal branched

## Solanaceae



### General remarks

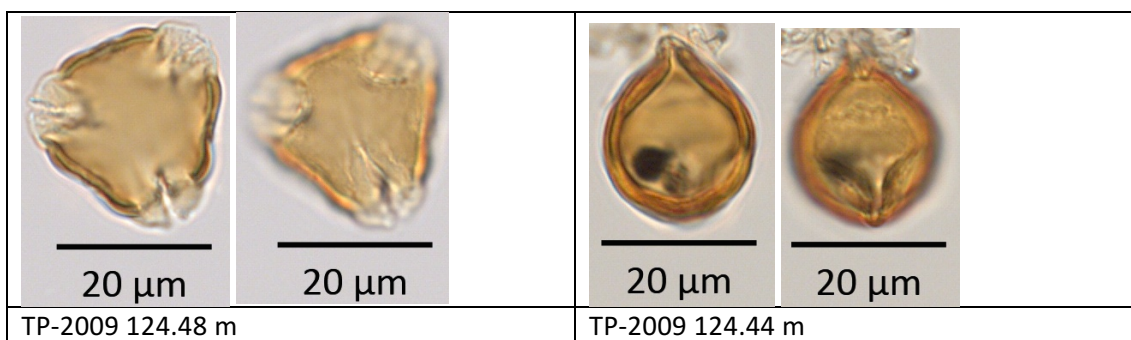
<b>Plant family</b>	Solanaceae
<b>Common names (English/German)</b>	Nightshades Nachtschattengewächse
<b>Palynomorph group</b>	Non-arboreal pollen
<b>Growth form</b>	Herbaceous perennials, annuals or biennials

### Characteristics

<b>Pollen class</b>	Tricolporate (± tricolporoidate, stephanocolporate, pericolporate, syncolporate)
<b>Pollen grain shape</b>	Sphaeroid, polar mostly triangular, eq. mostly rhomboid
<b>Pollen grain size</b>	12.3-33.0 µm
<b>Aperture</b>	Colpi transversales bulging, 4 x 1 µm
<b>Sculpture</b>	Psilate to slightly scabrate
<b>Sporoderm</b>	Exine 0.5-1.3 µm Columellae not visible



## *Verbena officinalis*



### General remarks

<b>Plant family</b>	Verbenaceae
<b>Common names (English/German)</b>	Common vervain Echtes Eisenkraut
<b>Palynomorph group</b>	Non-arboreal pollen
<b>Growth form</b>	Herbaceous perennials (± annuals)

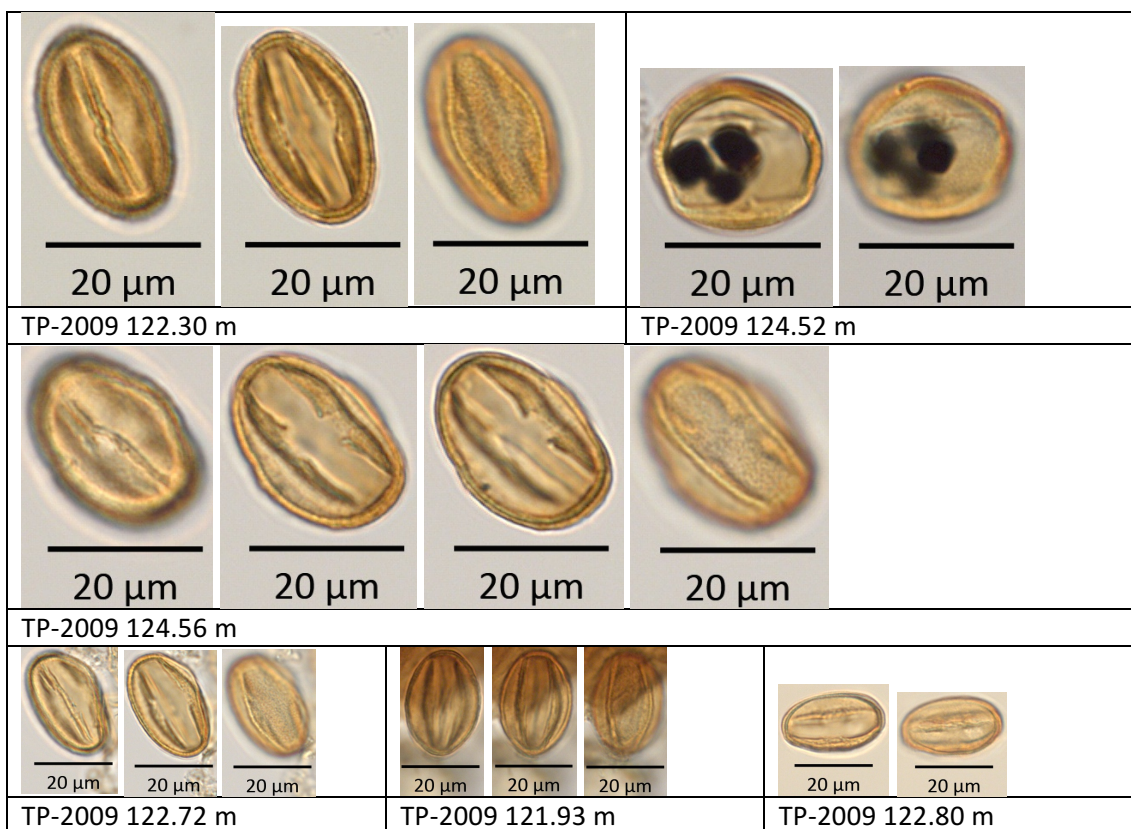
### Characteristics

<b>Pollen class</b>	Tricolporate
<b>Pollen grain shape</b>	Angular, slightly sphaeroid, eq. broader than long
<b>Pollen grain size</b>	17.5-24.8 µm
<b>Aperture</b>	Colpi transversales eq. distinct elongated and thin, bulged, 9-11 x 1-4 µm Colpi thin Furrow in ca. 5 µm distance parallel on both sides of the colpi, thin and mostly longer than colpi, furrows can be connected
<b>Sculpture</b>	Indistinct scabrate to verrucate (± rugulate)
<b>Sporoderm</b>	Exine 2.0-2.6 µm Columellae not visible

# Tricolporoidatae

psilate, scabrate, verrucate, microverrucate

### *Cornus mas* type

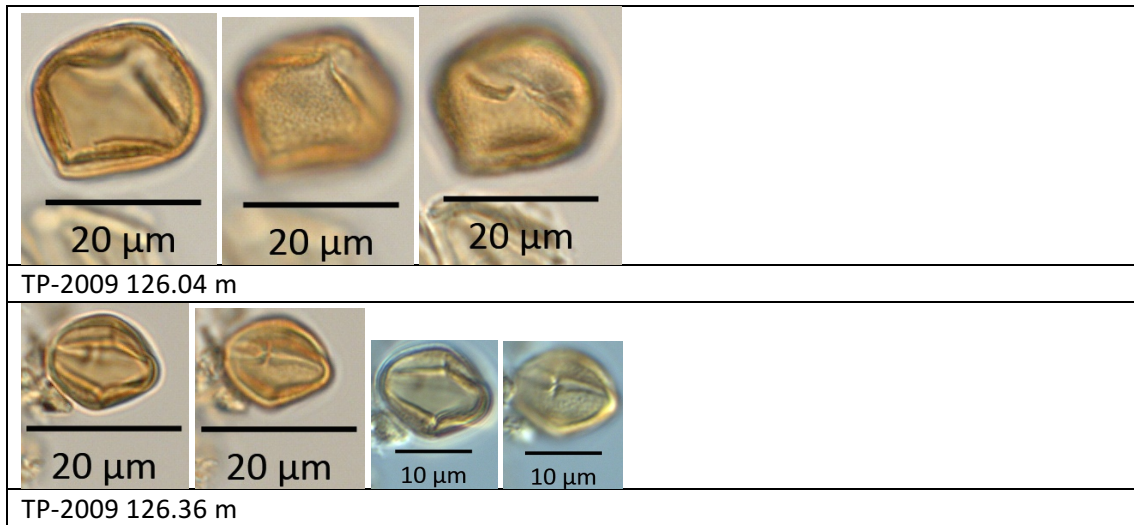


#### General remarks

<b>Plant family</b>	Cornaceae
<b>Common names (English/German)</b>	Cornelian cherry Kornelkirsche
<b>Palynomorph group</b>	Arboreal pollen
<b>Growth form</b>	Deciduous shrub

#### Characteristics

<b>Pollen class</b>	Tricolporoidate
<b>Pollen grain shape</b>	Sphaeroid to prolate
<b>Pollen grain size</b>	20.5-38.9 µm
<b>Aperture</b>	Colpus transversalis Intercolpi flattened to concave
<b>Sculpture</b>	Microverrucate (± verrucate)
<b>Sporoderm</b>	Exine tectate

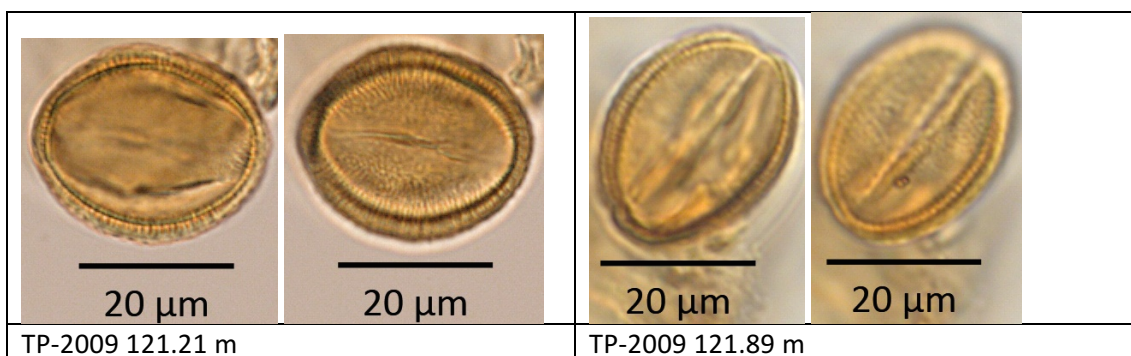
**Gratiola****General remarks**

<b>Plant family</b>	Plantaginaceae
<b>Common names (English/German)</b>	Hedgehyssops Gnadenkräuter
<b>Palynomorph group</b>	Non-arboreal pollen
<b>Growth form</b>	Herbaceous perennials to annuals

**Characteristics**

<b>Pollen class</b>	Tricolporoidate
<b>Pollen grain shape</b>	Sphaeroid, heteropolar: rounded and tapering hemispheres
<b>Pollen grain size</b>	17.0-22.3 µm
<b>Aperture</b>	
<b>Sculpture</b>	Psilate
<b>Sporoderm</b>	Exine 1.0-1.3 µm Columellae not visible

### *Mercurialis perennis* type



#### General remarks

<b>Plant family</b>	Euphorbiaceae
<b>Common names (English/German)</b>	Dog's mercury Wald-Bingelkraut
<b>Palynomorph group</b>	Non-arboreal pollen
<b>Growth form</b>	Herbaceous perennials

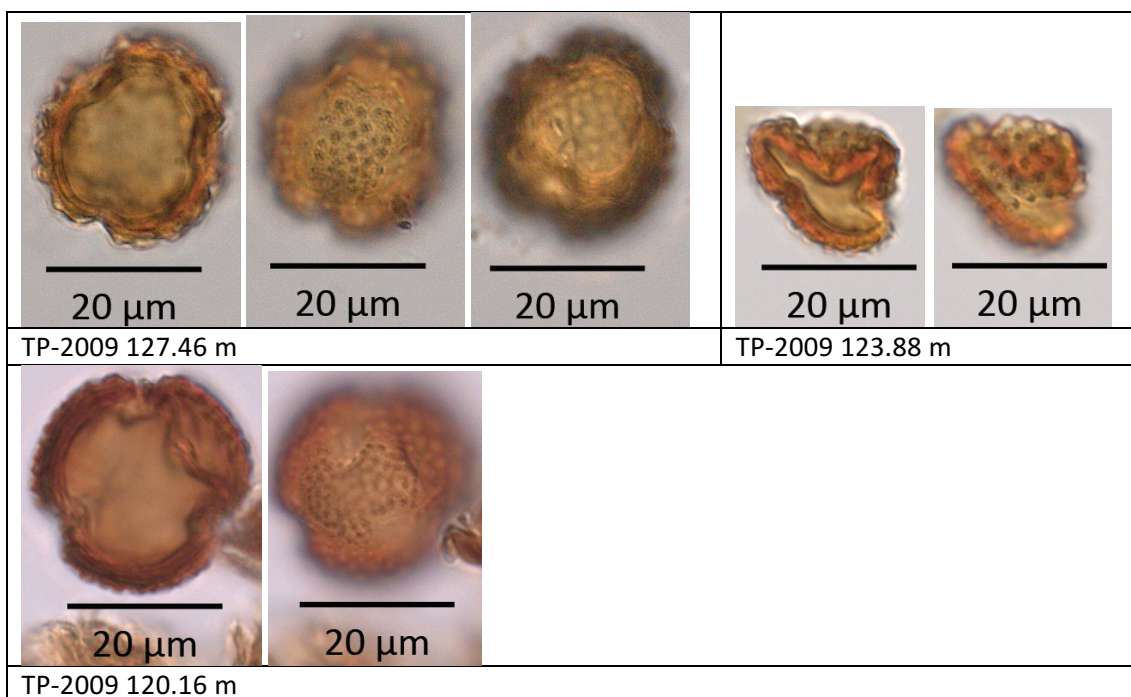
#### Characteristics

<b>Pollen class</b>	Tricolporoidate
<b>Pollen grain shape</b>	Sphaeroid-prolate, rhomboid
<b>Pollen grain size</b>	24.0-32.5 µm
<b>Aperture</b>	Colpi recessed
<b>Sculpture</b>	Verrucate
<b>Sporoderm</b>	Exine max. 2.5 µm Columellae thick, max. 1 µm
<b>Remarks</b>	<i>M. perennis</i> is more prolate than <i>M. annua</i>

**Tricolpatae,  
Tricolporatae,  
Tricolporoidatae**  
echinate



***Ambrosia/Xanthium spinosum* type**




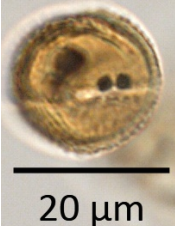
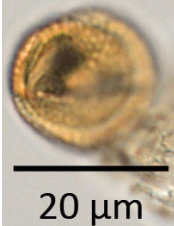

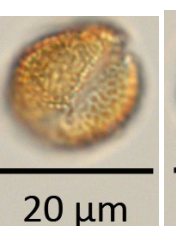


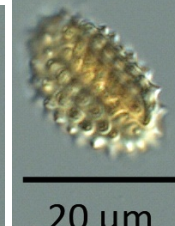
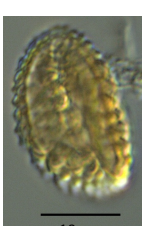

**General remarks**

<b>Plant family</b>	Asteraceae
<b>Common names (English/German)</b>	Ragweed/spiny cocklebur Traubenkraut/Dornige Spitzklette
<b>Palynomorph group</b>	Non-arboreal pollen
<b>Growth form</b>	Herbaceous perennials to annuals

**Characteristics**

<b>Pollen class</b>	Tricolporate
<b>Pollen grain shape</b>	Sphaeroid-prolate, interangular
<b>Pollen grain size</b>	18.1-25.1 µm
<b>Aperture</b>	Colpi short, 4-6 µm, pore-like, colpi transversales (8-10 µm)
<b>Sculpture</b>	Echinate, 2 µm long
<b>Sporoderm</b>	Columellae: outer not bipartite, 2 µm; inner reduced, 2-3 µm thick cavity; exine and endexine are gapping

## Asteraceae p.p.

					
Type 002. TP-2009 124.20 m			Type 002. TP-2009 127.42 m		
					
Type 001. TP-2009 121.00 m		TP-2009 124.50 m	Type 003. TP-2009 124.20 m		

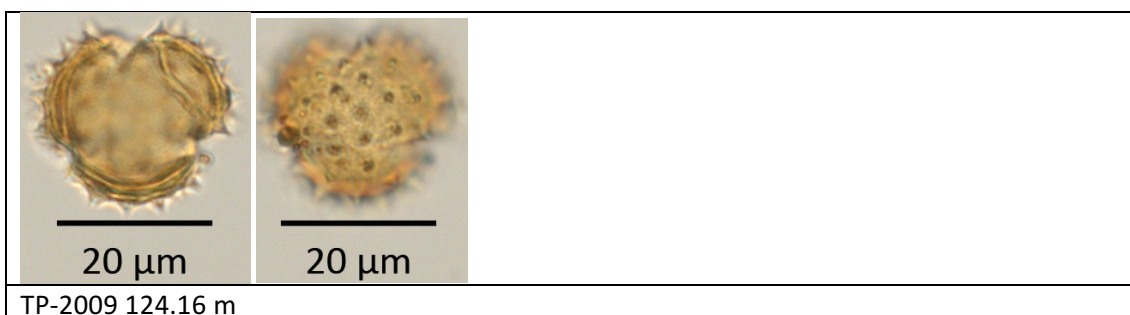
### General remarks

<b>Plant family</b>	Asteraceae
<b>Common names (English/German)</b>	Aster, daisy, composite or sunflower family Korbblütler
<b>Palynomorph group</b>	Non-arboreal pollen
<b>Growth form</b>	Herbaceous perennials to annuals

### Characteristics

<b>Pollen class</b>	Tricolporate, tricolporoidate
<b>Pollen grain shape</b>	Sphaeroid to prolate
<b>Pollen grain size</b>	17.2-95.5 µm
<b>Aperture</b>	Colpi middle to long (± short), pori or colpi transversales
<b>Sculpture</b>	Echinate
<b>Sporoderm</b>	Exine with tectum perforatum Columellae double-layered; outer columellae can be bipartite and inner columellae reduced (than cavity)

### ***Aster type (in Senecio/Solidago type)***



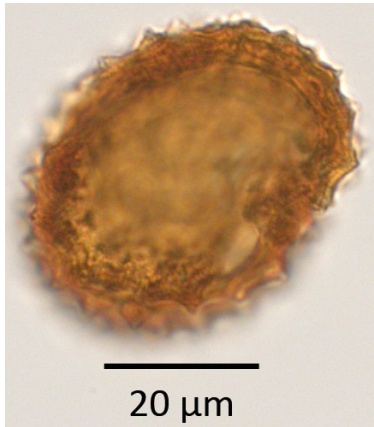

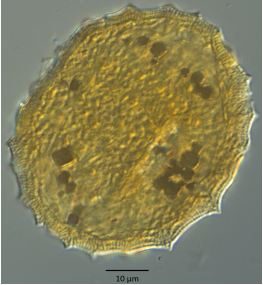
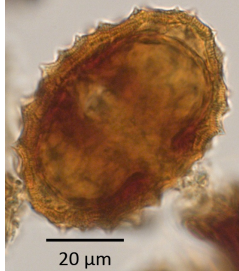
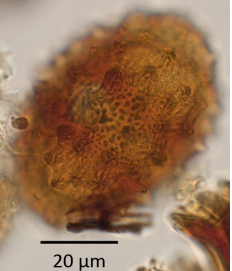
#### **General remarks**

<b>Plant family</b>	Asteraceae
<b>Common names (English/German)</b>	Aster, daisy, composite, sunflower Astern
<b>Palynomorph group</b>	Non-arboreal pollen
<b>Growth form</b>	Herbaceous perennials to annuals

#### **Characteristics**

<b>Pollen class</b>	Tricolporate
<b>Pollen grain shape</b>	Sphaeroid-circular
<b>Pollen grain size</b>	21.2-43.0 µm
<b>Aperture</b>	
<b>Sculpture</b>	Echinate
<b>Sporoderm</b>	

***Carthamus* type**

			
TP-2009 124.60 m		TP-2009 125.00 m	
			
TP-2009 125.48 m			

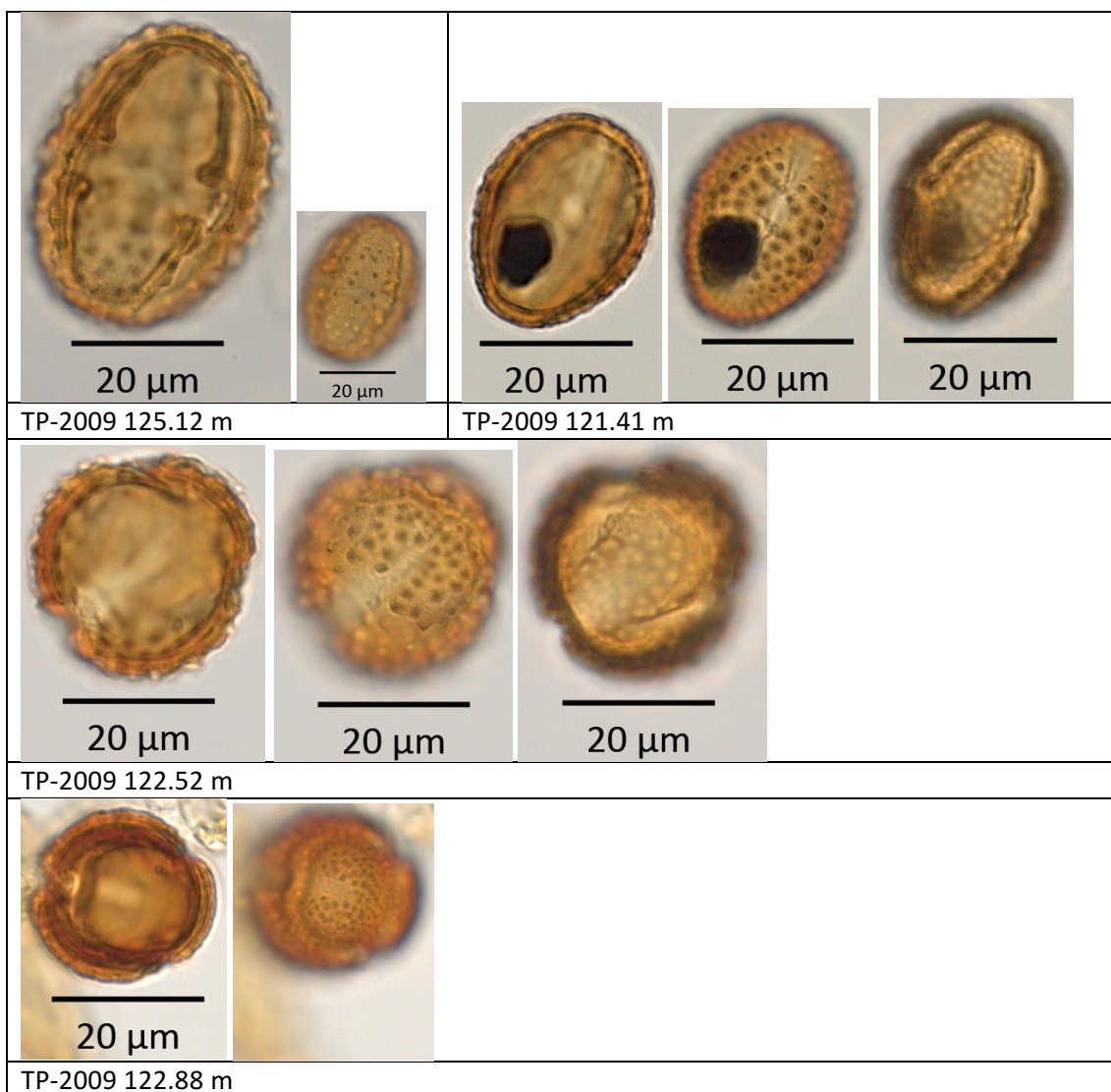
**General remarks**

<b>Plant family</b>	Asteraceae
<b>Common names (English/German)</b>	Distaff thistles Färberdisteln
<b>Palynomorph group</b>	Non-arboreal pollen
<b>Growth form</b>	Herbaceous annuals

**Characteristics**

<b>Pollen class</b>	
<b>Pollen grain shape</b>	Sphaeroid to prolate
<b>Pollen grain size</b>	50.5-75.4 µm
<b>Aperture</b>	Colpi short, colpi transversales
<b>Sculpture</b>	Echinate
<b>Sporoderm</b>	Exine without echini 6-8 µm Columellae: outer bipartite, corrugated; inner thin, reduced

***Centaurea jacea* type**



**General remarks**

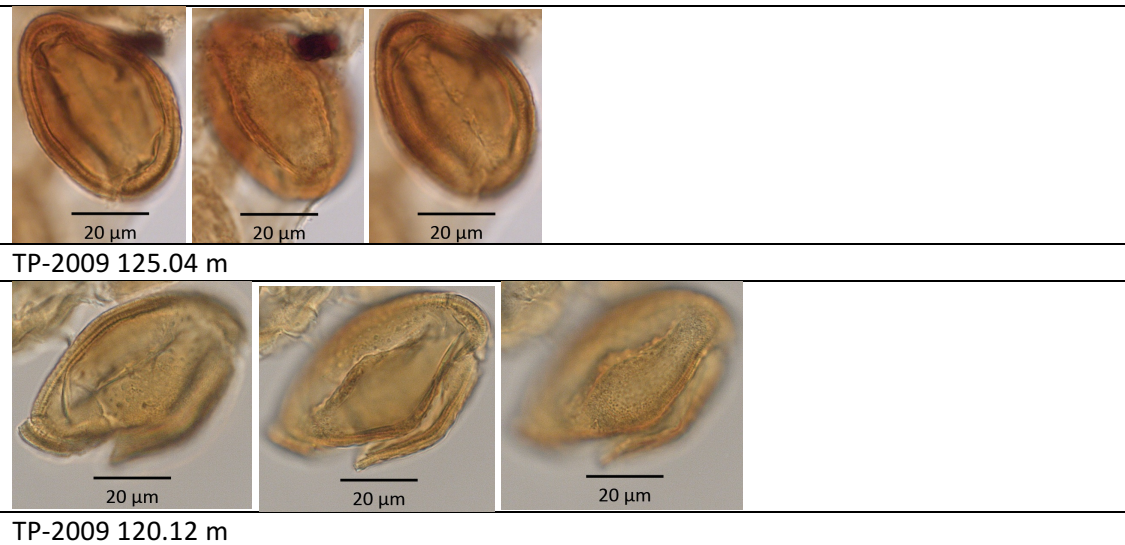
<b>Plant family</b>	Asteraceae
<b>Common names (English/German)</b>	Brown Knapweed Wiesen-Flockenblume
<b>Palynomorph group</b>	Non-arboreal pollen
<b>Growth form</b>	Herbaceous perennials

**Characteristics**

<b>Pollen class</b>	Tricolporate
<b>Pollen grain shape</b>	Sphaeroid-prolate
<b>Pollen grain size</b>	29.7-49.3 µm
<b>Aperture</b>	Colpi transversales with costae
<b>Sculpture</b>	Echinate or scabrate, 1-2 µm long, 4-5 µm broad
<b>Sporoderm</b>	Exine polar 3.6-6.8 µm Columellae: outer 1.5-3 µm, inner absent



### *Centranthus* type



#### General remarks

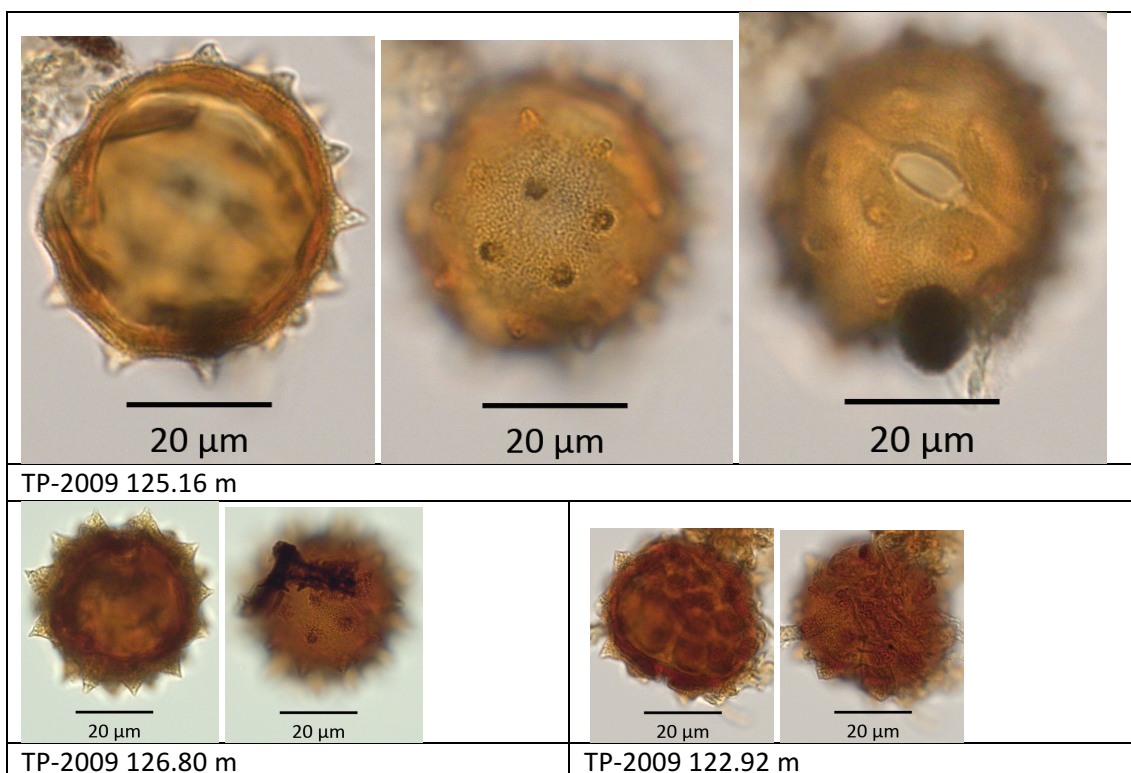
<b>Plant family</b>	Caprifoliaceae
<b>Common names (English/German)</b>	Valerian Spornblumen
<b>Palynomorph group</b>	Non-arboreal pollen
<b>Growth form</b>	Herbaceous perennials to annuals

#### Characteristics

<b>Pollen class</b>	Tricolpate
<b>Pollen grain shape</b>	Sphaeroid to prolate
<b>Pollen grain size</b>	52.3-77.3 µm
<b>Aperture</b>	
<b>Sculpture</b>	Echinate, 1.0-1.2 µm long, (1.0-)1.2-1.5 µm broad
<b>Sporoderm</b>	Exine eq. 3.0-5.0 µm, polar (5.5-)6.0-8.0 µm



## *Cirsium* type



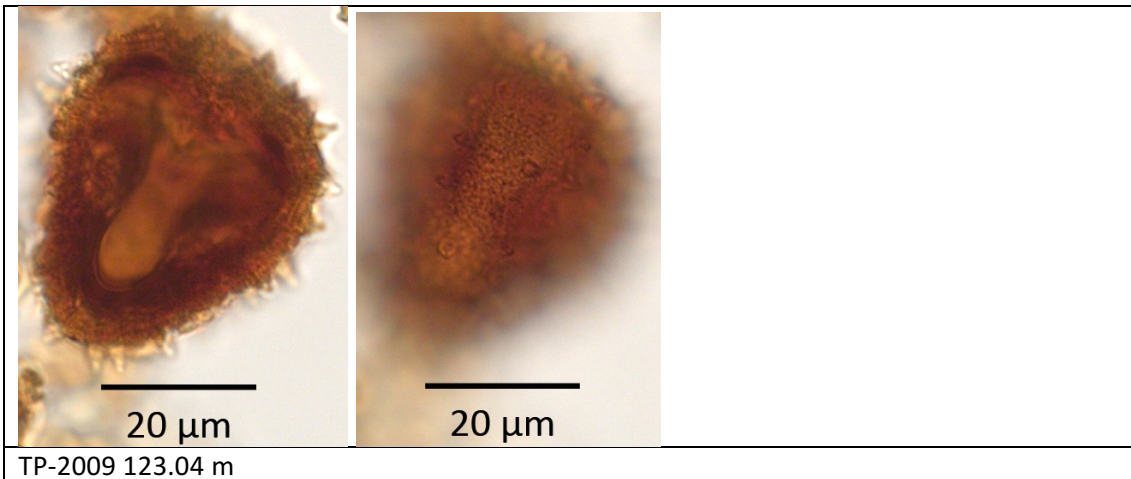
### General remarks

<b>Plant family</b>	Asteraceae
<b>Common names (English/German)</b>	Thistles Kratzdisteln
<b>Palynomorph group</b>	Non-arboreal pollen
<b>Growth form</b>	Herbaceous perennials, annuals or biennials

### Characteristics

<b>Pollen class</b>	Tricolporate
<b>Pollen grain shape</b>	Sphaeroid-circular
<b>Pollen grain size</b>	38.9-77.2 µm
<b>Aperture</b>	
<b>Sculpture</b>	Echinate, (3-)5-7 µm long
<b>Sporoderm</b>	Exine without echini 4-8 µm Columellae: outer 2 µm, corrugated; inner <2 µm, unbranched

## *Crupina*



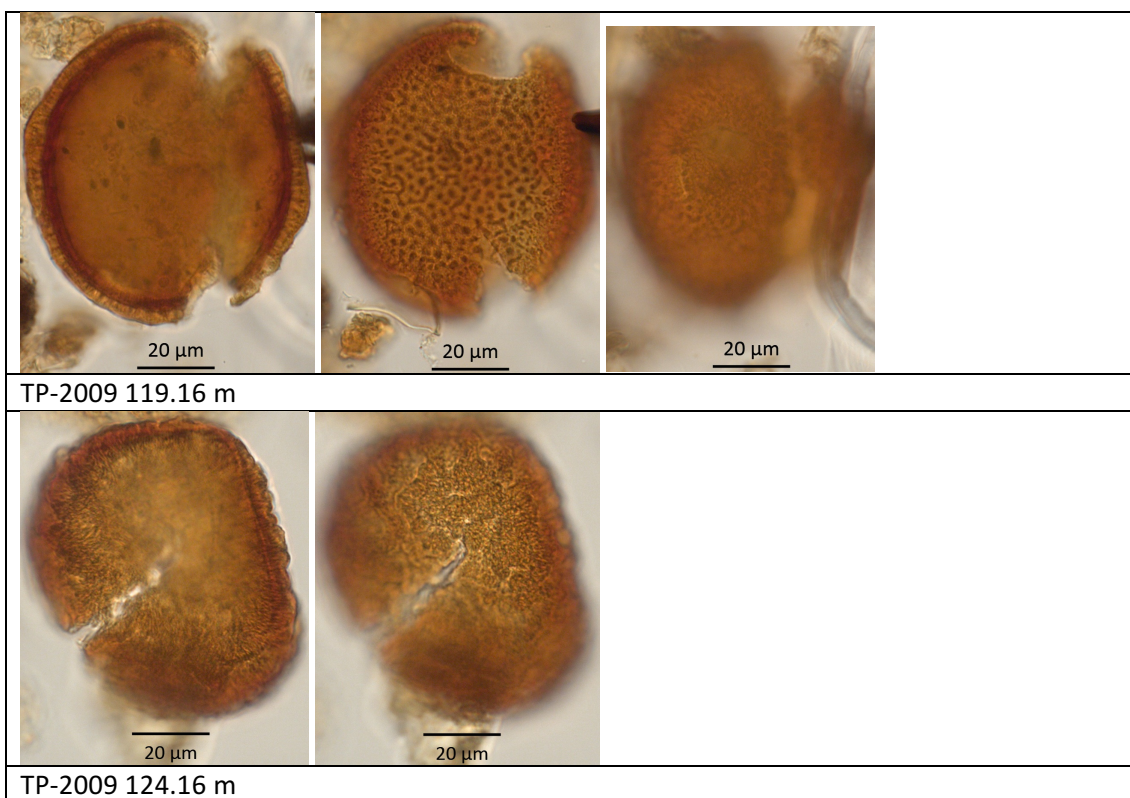
### General remarks

<b>Plant family</b>	Asteraceae
<b>Common names (English/German)</b>	Schlupfsamen
<b>Palynomorph group</b>	Non-arboreal pollen
<b>Growth form</b>	Herbaceous annuals

### Characteristics

<b>Pollen class</b>	Tricolporate
<b>Pollen grain shape</b>	Sphaeroid
<b>Pollen grain size</b>	47.8-58.4 µm
<b>Aperture</b>	Colpi short, colpi transversales without costae
<b>Sculpture</b>	Echinate, 2.5-5.0 µm
<b>Sporoderm</b>	Exine without echini 5-6(-11) µm Columellae: inner layer thin and outer layer two-layerd

## Dipsacaceae p.p.



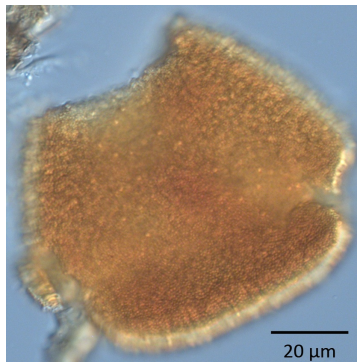
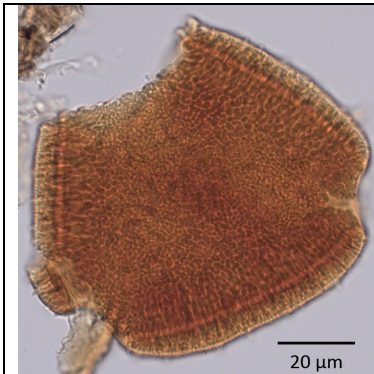
### General remarks

<b>Plant family</b>	Caprifoliaceae
<b>Common names (English/German)</b>	Teasel family Kardengewächse
<b>Palynomorph group</b>	Non-arboreal pollen
<b>Growth form</b>	Herbaceous perennials to annuals (± subshrub)

### Characteristics

<b>Pollen class</b>	Tricolpate, triporate (± tetracolpate, tetraporate)
<b>Pollen grain shape</b>	Sphaeroid, elliptic to rhomboid
<b>Pollen grain size</b>	53.1-106.1 µm
<b>Aperture</b>	Pori recessed, mostly with annulus Colpi recessed
<b>Sculpture</b>	Dimporh echinate, microechini 0.5-1.5 µm, large echini max. 3 µm
<b>Sporoderm</b>	Exine 6.0-9.0(-10.0) µm, tectate Columellae: branched inner layer and outer layer Sporoderm thick-walled

**Dipsacaceae**  
***Scabiosa* type**



TP-2009 127.38 m

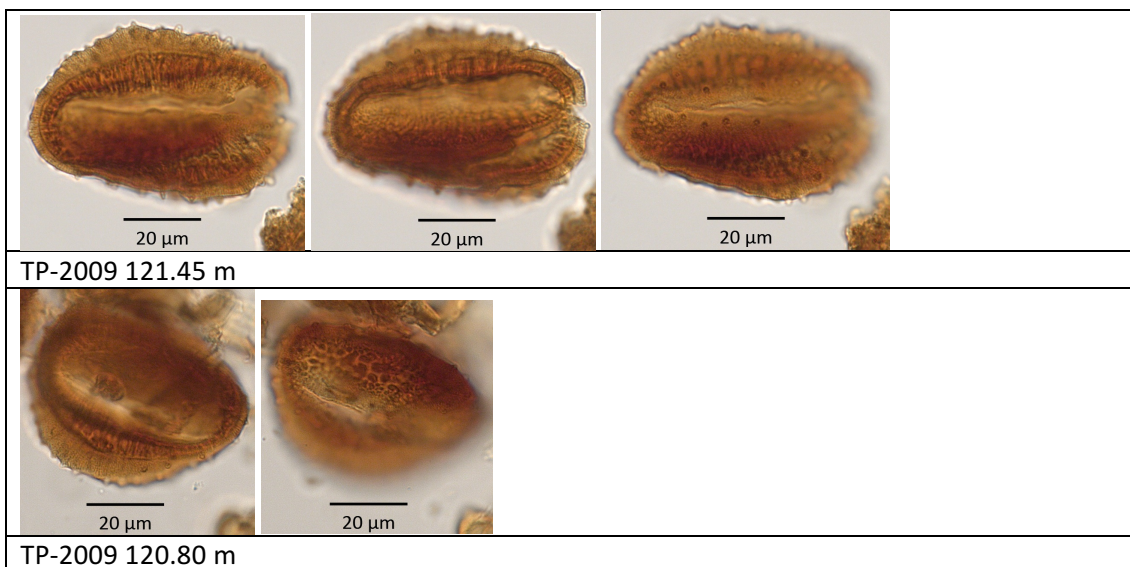
**General remarks**

<b>Plant family</b>	Caprifoliaceae
<b>Common names (English/German)</b>	Scabious, pincushion flowers Skabiosen
<b>Palynomorph group</b>	Non-arboreal pollen
<b>Growth form</b>	Herbaceous perennials to annuals

**Characteristics**

<b>Pollen class</b>	Tricolpate, triporate
<b>Pollen grain shape</b>	Elliptic to rhomboid, polar triangular
<b>Pollen grain size</b>	60.5-106.1 µm
<b>Aperture</b>	Colpi thin, without opercula, pores recessed
<b>Sculpture</b>	Gemmate and/or echinate, echini 1.5-3.0 µm, microechini 0.5 µm
<b>Sporoderm</b>	Exine 7-9(-10) µm, in rhomboid PG polar thickened to 14 µm Columellae: inner layer not branched

## *Echinops*



### General remarks


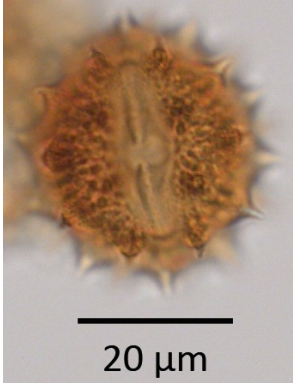
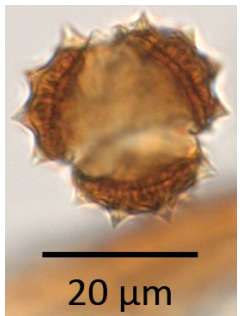
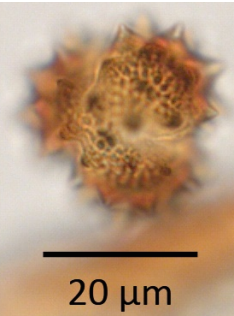
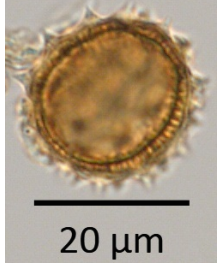
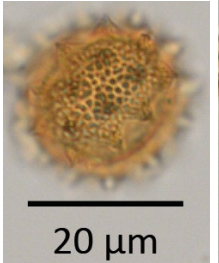


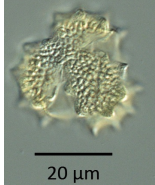
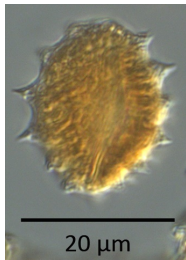
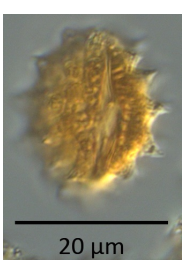
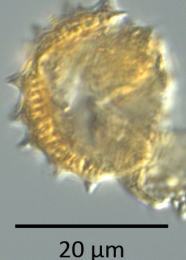
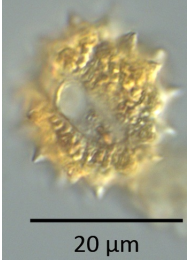
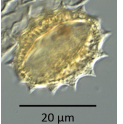
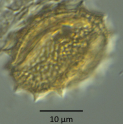
<b>Plant family</b>	Asteraceae
<b>Common names (English/German)</b>	Globe thistles Kugeldisteln
<b>Palynomorph group</b>	Non-arboreal pollen
<b>Growth form</b>	Herbaceous perennials

### Characteristics

<b>Pollen class</b>	
<b>Pollen grain shape</b>	PG sphaeroid to prolate
<b>Pollen grain size</b>	PG 49.6-95.5 µm
<b>Aperture</b>	Colpi short, less than half as long as pole axis, colpi transversales
<b>Sculpture</b>	Echinate, max. 2 µm long
<b>Sporoderm</b>	Columellae: outer associated, inner distal branched



***Matricaria/Achillea* type**

 20 µm		 20 µm		 20 µm	 20 µm
TP-2009 123.88 m		TP-2009 121.57 m			
 20 µm	 20 µm	 20 µm		 20 µm	 20 µm
TP-2009 123.64 m		TP-2009 124.50 m			
 20 µm	 20 µm	 20 µm	 20 µm	 20 µm	 20 µm
TP-2009 126.00 m		TP-2009 125.00 m			

**General remarks**

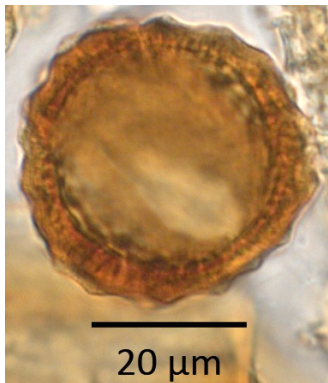

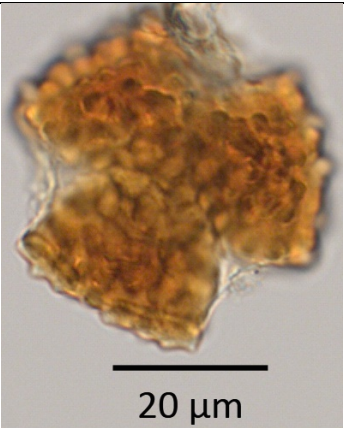
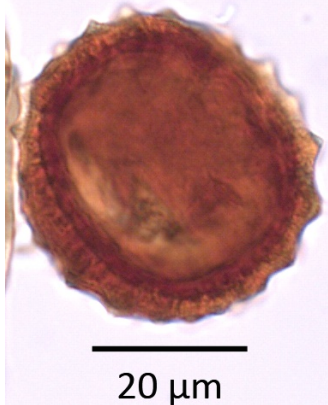
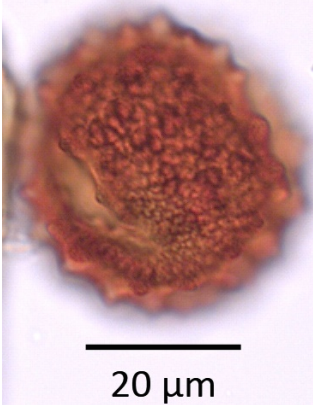
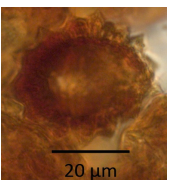
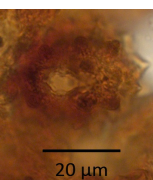
<b>Plant family</b>	Asteraceae
<b>Common names (English/German)</b>	Mayweed/yarrow Kamillen/Schafgarben
<b>Palynomorph group</b>	Non-arboreal pollen
<b>Growth form</b>	Herbaceous annuals

**Characteristics**

<b>Pollen class</b>	Tricolporate
<b>Pollen grain shape</b>	Sphaeroid-circular
<b>Pollen grain size</b>	22.0-40.0 µm
<b>Aperture</b>	Colpi long
<b>Sculpture</b>	Echinate, 3-4 µm long
<b>Sporoderm</b>	Exine without echini 3-5(>5) µm Columellae: outer <1 µm; inner distal branched, 1.5-3.5 µm



### *Saussurea/Arctium* type

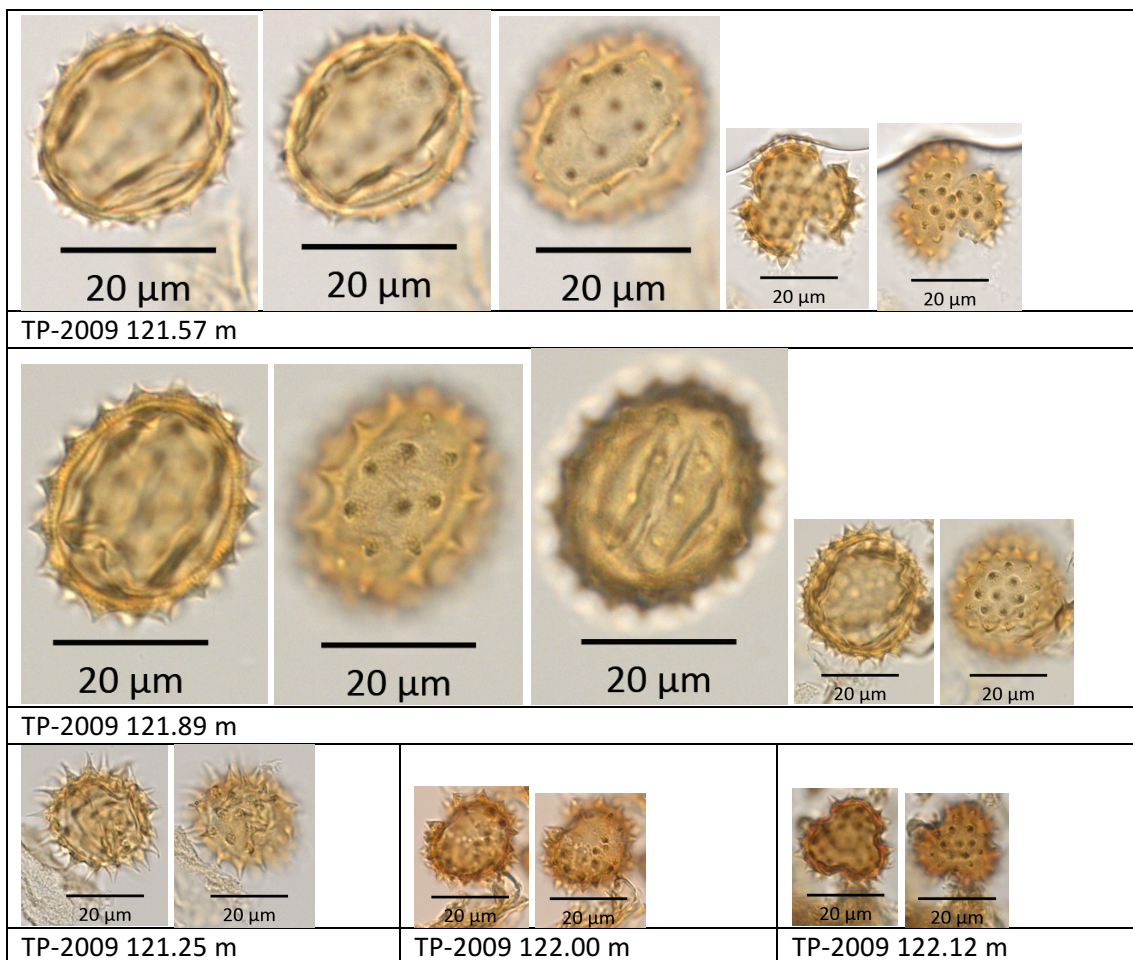
 		
TP-2009 121.37 m		TP-2009 121.25 m
 		 
TP-2009 119.92 m		TP-2009 127.18 m

#### General remarks

<b>Plant family</b>	Asteraceae
<b>Common names (English/German)</b>	Saw-wort/burdock Alpenscharten/Kletten
<b>Palynomorph group</b>	Non-arboreal pollen
<b>Growth form</b>	Herbaceous perennials, annuals or biennials

#### Characteristics

<b>Pollen class</b>	Tricolporate
<b>Pollen grain shape</b>	Sphaeroid-prolate
<b>Pollen grain size</b>	28.3-68.8 µm
<b>Aperture</b>	
<b>Sculpture</b>	Echinate, 1-5 µm long
<b>Sporoderm</b>	Exine without echini 6.0-9.3 µm Columellae: outer 1.5-3.0 µm; inner 3.0-5.5 µm, distal branched

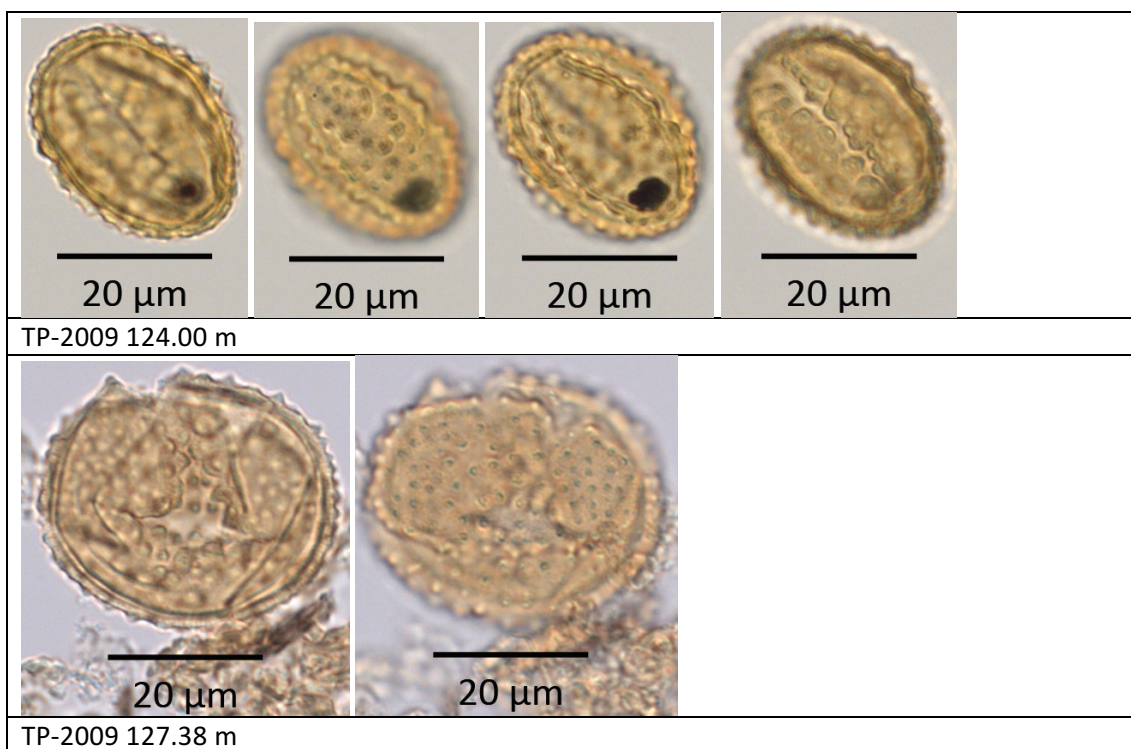
***Senecio/Solidago* type****General remarks**

<b>Plant family</b>	Asteraceae
<b>Common names (English/German)</b>	Ragworts/goldenrods Greiskräuter/Goldruten
<b>Palynomorph group</b>	Non-arboreal pollen
<b>Growth form</b>	Herbaceous perennials, annuals or biennials

**Characteristics**

<b>Pollen class</b>	Tricolporate
<b>Pollen grain shape</b>	Sphaeroid-circular
<b>Pollen grain size</b>	17.2-52.4 µm
<b>Aperture</b>	
<b>Sculpture</b>	Echinate, (2-)3-6(-7) µm long, 2-5(-6) µm broad
<b>Sporoderm</b>	Exine without echini (1.5-)2-4(-5) µm Columellae: outer 1-2(-2.5) µm, inner reduced

### *Valeriana officinalis* group



#### General remarks

<b>Plant family</b>	Caprifoliaceae
<b>Common names (English/German)</b>	Garden valerian Echter Baldrian
<b>Palynomorph group</b>	Non-arboreal pollen
<b>Growth form</b>	Herbaceous perennials

#### Characteristics

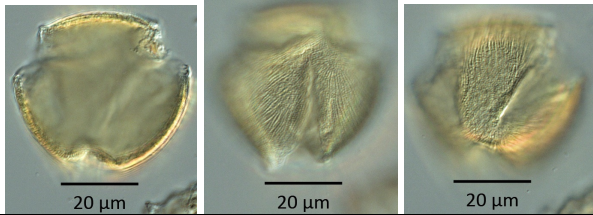
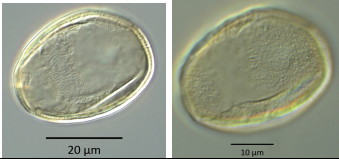
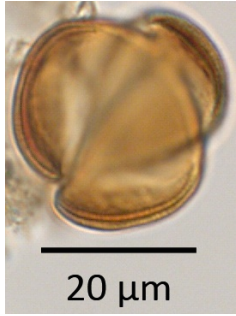


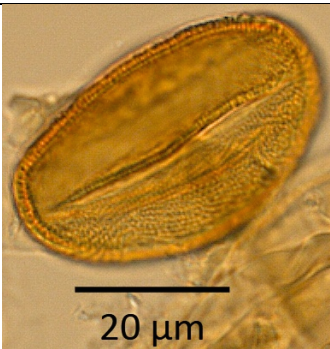



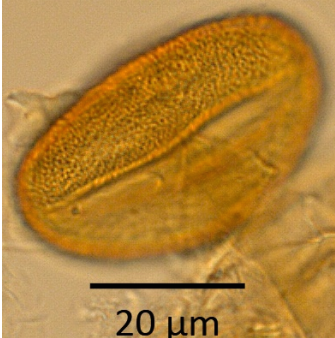
<b>Pollen class</b>	Tricolpate
<b>Pollen grain shape</b>	Sphaeroid
<b>Pollen grain size</b>	35.5-67.5 µm
<b>Aperture</b>	Colpi thin, granulous
<b>Sculpture</b>	Echinate (1.3-2.0(-3.0)) or echinate with small scabrate elements (echini 1.4-1.8 µm)
<b>Sporoderm</b>	Exine without echini 2.5-3.0 µm

# Tricolpatae

striate, striate-reticulate, rugulate



**Acer**

			
TP-2009 121.00 m			TP-2009 125.00 m
			
TP-2009 124.92 m			TP-2009 127.87 m
			
TP-2009 124.44 m			TP-2009 127.87 m

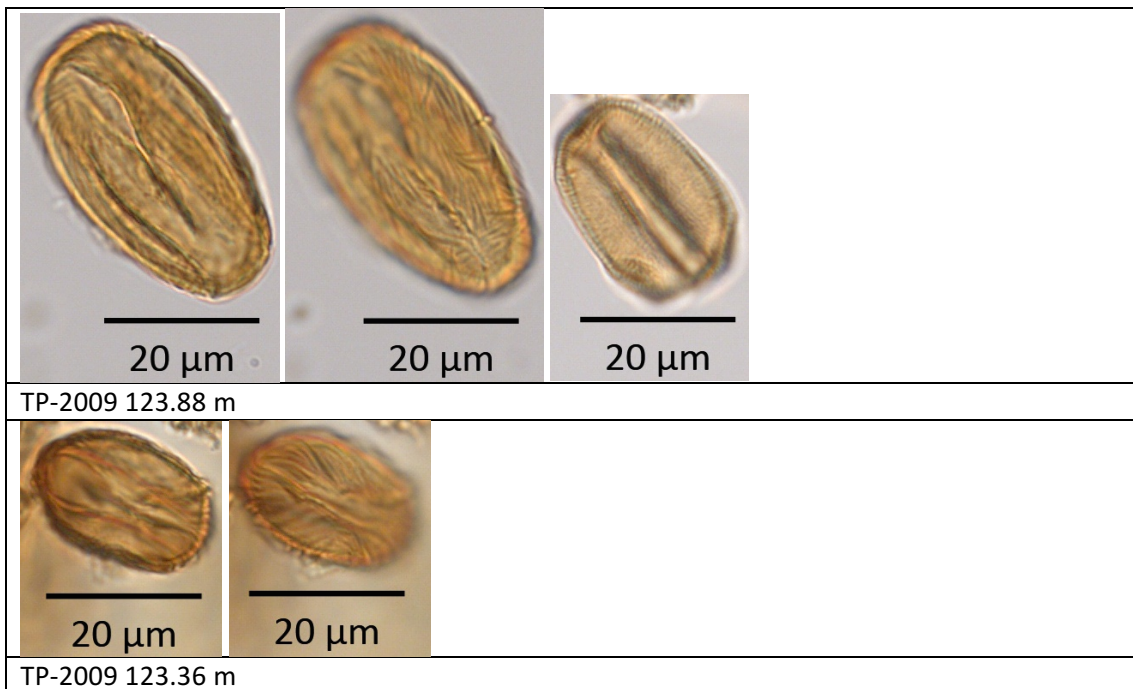
**General remarks**

<b>Plant family</b>	Sapindaceae
<b>Common names (English/German)</b>	Maple Ahorne
<b>Palynomorph group</b>	Arboreal pollen
<b>Growth form</b>	Deciduous (± indeciduous) tree

**Characteristics**

<b>Pollen class</b>	Tricolpate
<b>Pollen grain shape</b>	Sphaeroid to prolate
<b>Pollen grain size</b>	25.0-48.5 µm
<b>Aperture</b>	Intercolpium margins straight and parallel
<b>Sculpture</b>	Striate, valla meridional, max. 0.5 µm broad
<b>Sporoderm</b>	Exine 1.5-2.5 µm Columellae distinct

***Saxifraga aizoides* group**



**General remarks**

<b>Plant family</b>	Saxifragaceae
<b>Common names (English/German)</b>	Yellow Mountain Saxifrage Fetthennen-Steinbrech
<b>Palynomorph group</b>	Non-arboreal pollen
<b>Growth form</b>	Herbaceous perennials

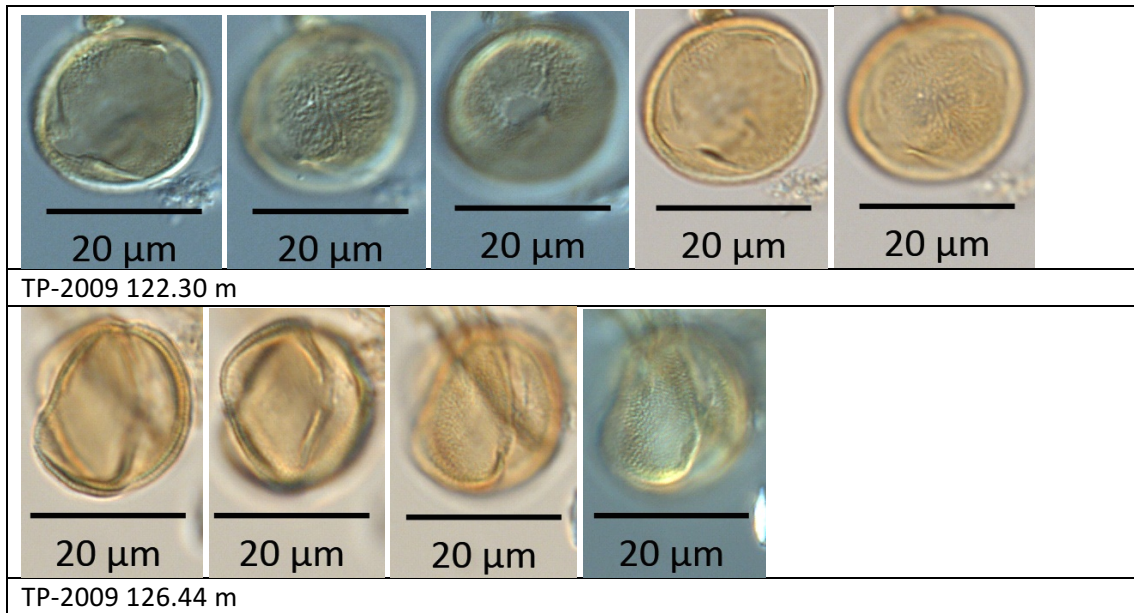
**Characteristics**

<b>Pollen class</b>	Tricolpate
<b>Pollen grain shape</b>	Sphaeroid to prolate
<b>Pollen grain size</b>	18.0-42.0 µm
<b>Aperture</b>	Colpi thin to broad ( $\pm$ eq. constricted)
<b>Sculpture</b>	Striate, valla transversal, 0.5-1.2 µm broad
<b>Sporoderm</b>	Exine (1.2-)1.5-2.5(-2.9)



# Tricolporatae

striate, striate-reticulate, rugulate

***Coronilla* type****General remarks**

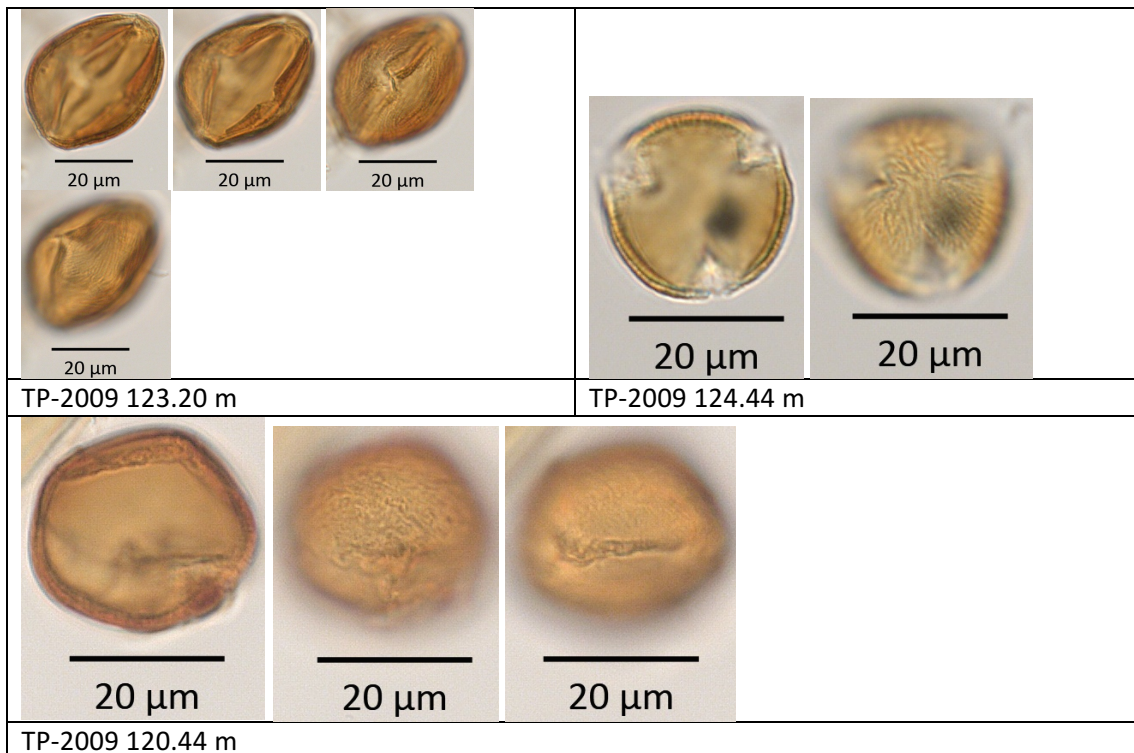
<b>Plant family</b>	Fabaceae
<b>Common names (English/German)</b>	Kronwicken
<b>Palynomorph group</b>	Non-arboreal pollen
<b>Growth form</b>	Herbaceous perennials (± annuals), shrubs

**Characteristics**

<b>Pollen class</b>	Tricolporate (± tricolporoidate)
<b>Pollen grain shape</b>	Angulaperturate
<b>Pollen grain size</b>	17.5-35.0 µm
<b>Aperture</b>	Pori 3.5-7 x 6.5-13 µm, transversal elongated, butterfly-like
<b>Sculpture</b>	Psilate, psilate-scabrate, rugulate, microreticulate
<b>Sporoderm</b>	Exine 1.0-1.5 µm
<b>Remarks</b>	<i>Securigia varia</i> : sculpture elements max. 10 µm long

# Tricolporoidatae

striate, striate-reticulate, rugulate

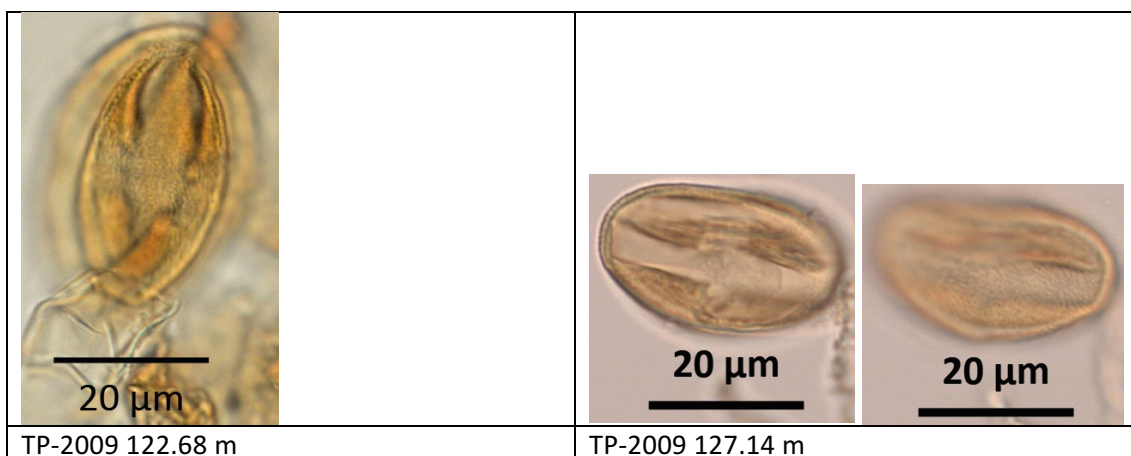
***Prunus* type (in *Sorbus* group)****General remarks**

<b>Plant family</b>	Rosaceae
<b>Common names (English/German)</b>	Stone fruit plants Steinfrucht-Pflanzen
<b>Palynomorph group</b>	Arboreal pollen
<b>Growth form</b>	Deciduous (± indeciduous) tree or shrub

**Characteristics**

<b>Pollen class</b>	Tricolporoidate
<b>Pollen grain shape</b>	Sphaeroid, eq. circular to elliptic
<b>Pollen grain size</b>	21.1-56.1 µm
<b>Aperture</b>	
<b>Sculpture</b>	Striate, tectum imperforatum
<b>Sporoderm</b>	Exine 2.0-3.0 µm

### ***Rubus* type (in *Sorbus* group)**




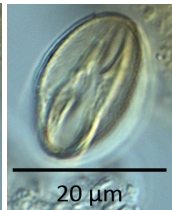


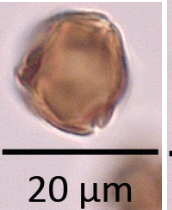

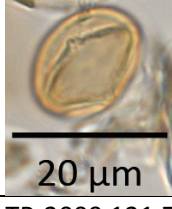
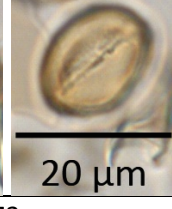
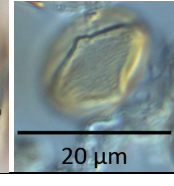
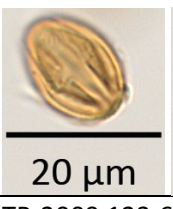
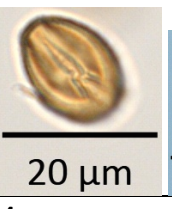
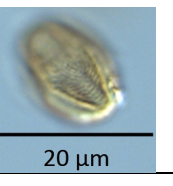

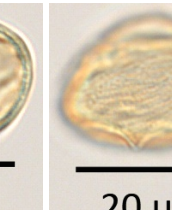
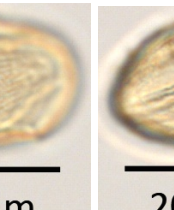
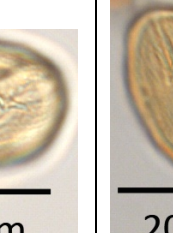
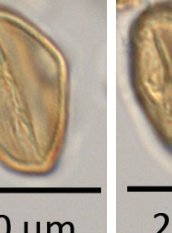
#### **General remarks**

<b>Plant family</b>	Rosaceae
<b>Common names (English/German)</b>	Berries Beeren
<b>Palynomorph group</b>	Arboreal pollen
<b>Growth form</b>	Deciduous (± indeciduous) creeper (± shrub or herbaceous perennials)

#### **Characteristics**

<b>Pollen class</b>	Tricolporoidate
<b>Pollen grain shape</b>	Sphaeroid
<b>Pollen grain size</b>	15.5-31.7 µm
<b>Aperture</b>	Colpi eq. simple or s-shaped recessed
<b>Sculpture</b>	Striate, valla short, valla and tectum perforatum with low contrast
<b>Sporoderm</b>	

## *Sorbus* group

					
TP-2009 122.68 m		TP-2009 123.44 m		TP-2009 120.16 m	
					
TP-2009 121.73 m			TP-2009 123.64 m		
					
TP-2009 124.56 m			TP-2009 122.34 m		

### General remarks

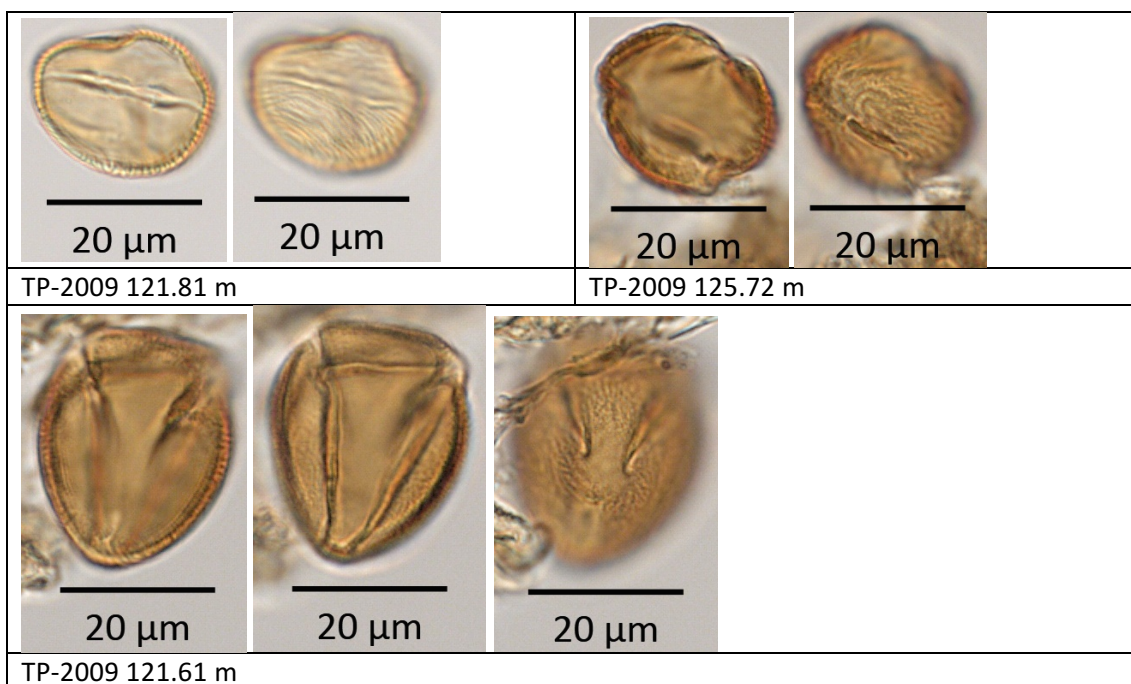
<b>Plant family</b>	Rosaceae
<b>Common names (English/German)</b>	Whitebeam, rowan, service tree, mountain-ash Mehlbeeren
<b>Palynomorph group</b>	Arboreal pollen
<b>Growth form</b>	Deciduous tree or shrub

### Characteristics

<b>Pollen class</b>	Tricolporoidate
<b>Pollen grain shape</b>	Sphaeroid to prolate, eq. circular, elliptic or spindle-shaped
<b>Pollen grain size</b>	15.5-56.1 µm
<b>Aperture</b>	Colpi variable, simple, s-shaped recessed or low contrast pori
<b>Sculpture</b>	Striate, valla short or long, variable
<b>Sporoderm</b>	



## Geum type




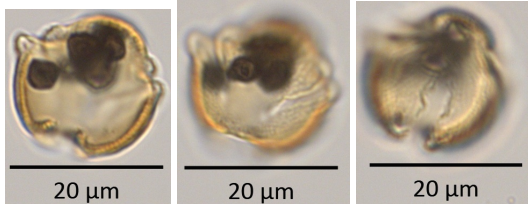

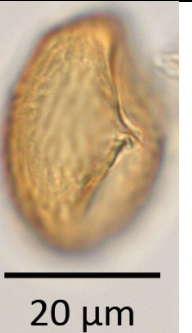
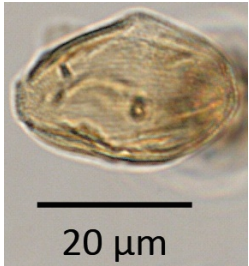
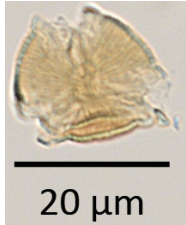
### General remarks

<b>Plant family</b>	Rosaceae
<b>Common names (English/German)</b>	Avens Nelkenwurz
<b>Palynomorph group</b>	Non-arboreal pollen
<b>Growth form</b>	Herbaceous perennials

### Characteristics

<b>Pollen class</b>	Tricolporoidate
<b>Pollen grain shape</b>	Sphaeroid
<b>Pollen grain size</b>	19.8-39.6 µm
<b>Aperture</b>	Colpi constricted, no operculum (as contrasted with <i>Potentilla</i> type)
<b>Sculpture</b>	Striate, valla broad, long, meridional (± angular, transversal)
<b>Sporoderm</b>	Exine 1.0-1.8 µm

**Potentilla type**

			
TP-2009 124.50 m			
			
TP-2009 124.52 m			
			
TP-2009 124.56 m	TP-2009 122.76 m		TP-2009 123.68 m

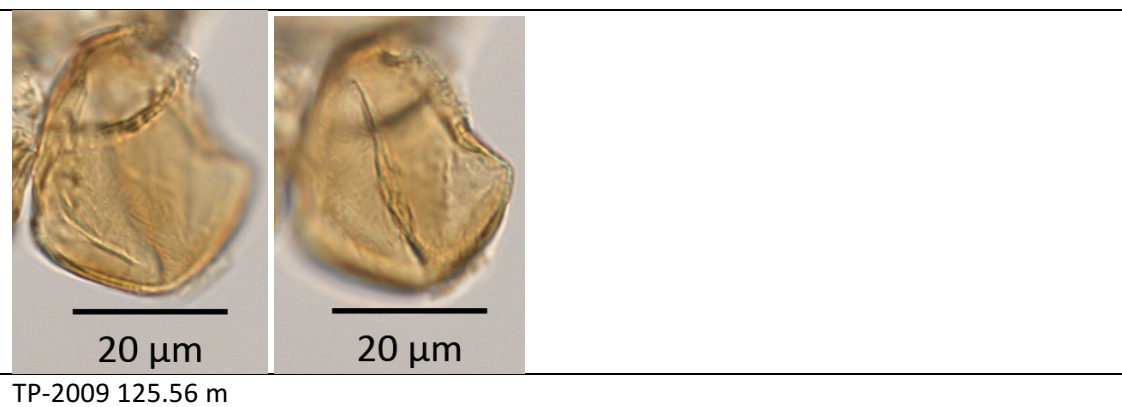
**General remarks**

<b>Plant family</b>	Rosaceae
<b>Common names (English/German)</b>	Cinquefoils Fingerkräuter
<b>Palynomorph group</b>	Non-arboreal pollen
<b>Growth form</b>	Herbaceous perennials (± herbaceous annuals, biennials or shrubs)

**Characteristics**

<b>Pollen class</b>	Tricolporoidate
<b>Pollen grain shape</b>	Sphaeroid-prolate, eq. elliptic
<b>Pollen grain size</b>	15.8-46.2 µm
<b>Aperture</b>	Colpi operculate, operculum and intercolpium margins form vesiculae, 3 vesiculae-like bulges in eq. colpus area
<b>Sculpture</b>	Striate, valla distinct, mostly meridional
<b>Sporoderm</b>	Exine 1.1-1.2 µm

## *Sedum* type



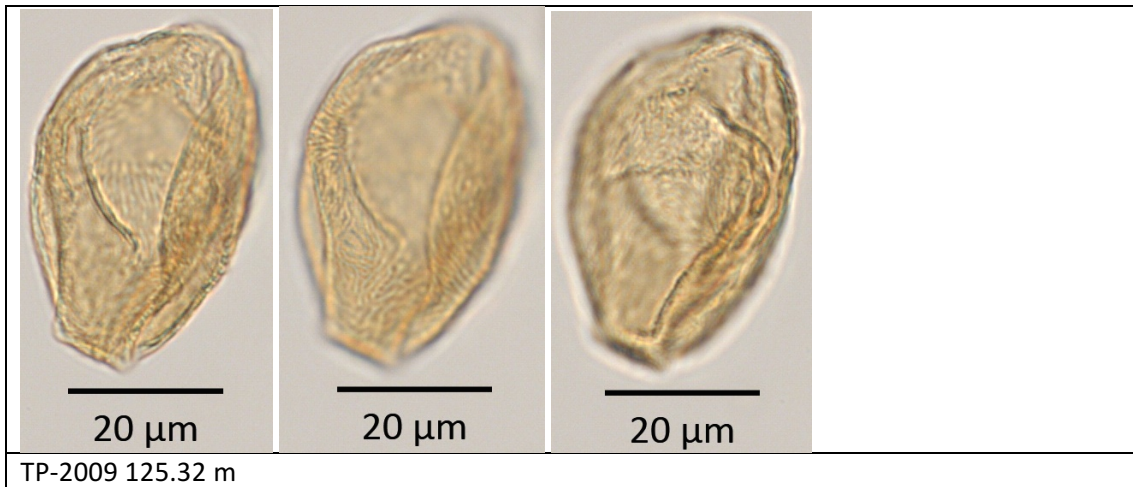
### General remarks

<b>Plant family</b>	Crassulaceae
<b>Common names (English/German)</b>	Stonecrops Fetthennen
<b>Palynomorph group</b>	Non-arboreal pollen
<b>Growth form</b>	Herbaceous perennials or annuals

### Characteristics

<b>Pollen class</b>	Tricolporoidate, tricolporate
<b>Pollen grain shape</b>	Sphaeroid to prolate
<b>Pollen grain size</b>	10.0-36.3 µm
<b>Aperture</b>	Colpi long
<b>Sculpture</b>	Rugulate, striate or psilate-scabrate
<b>Sporoderm</b>	Exine 1.1-1.6(-2.0) µm (± polar max. 2.5 µm)

## *Menyanthes trifoliata*



### General remarks

<b>Plant family</b>	Menyanthaceae
<b>Common names (English/German)</b>	Bog-bean Fieberklee
<b>Palynomorph group</b>	<a href="#">Aquatic</a>
<b>Growth form</b>	Herbaceous perennials

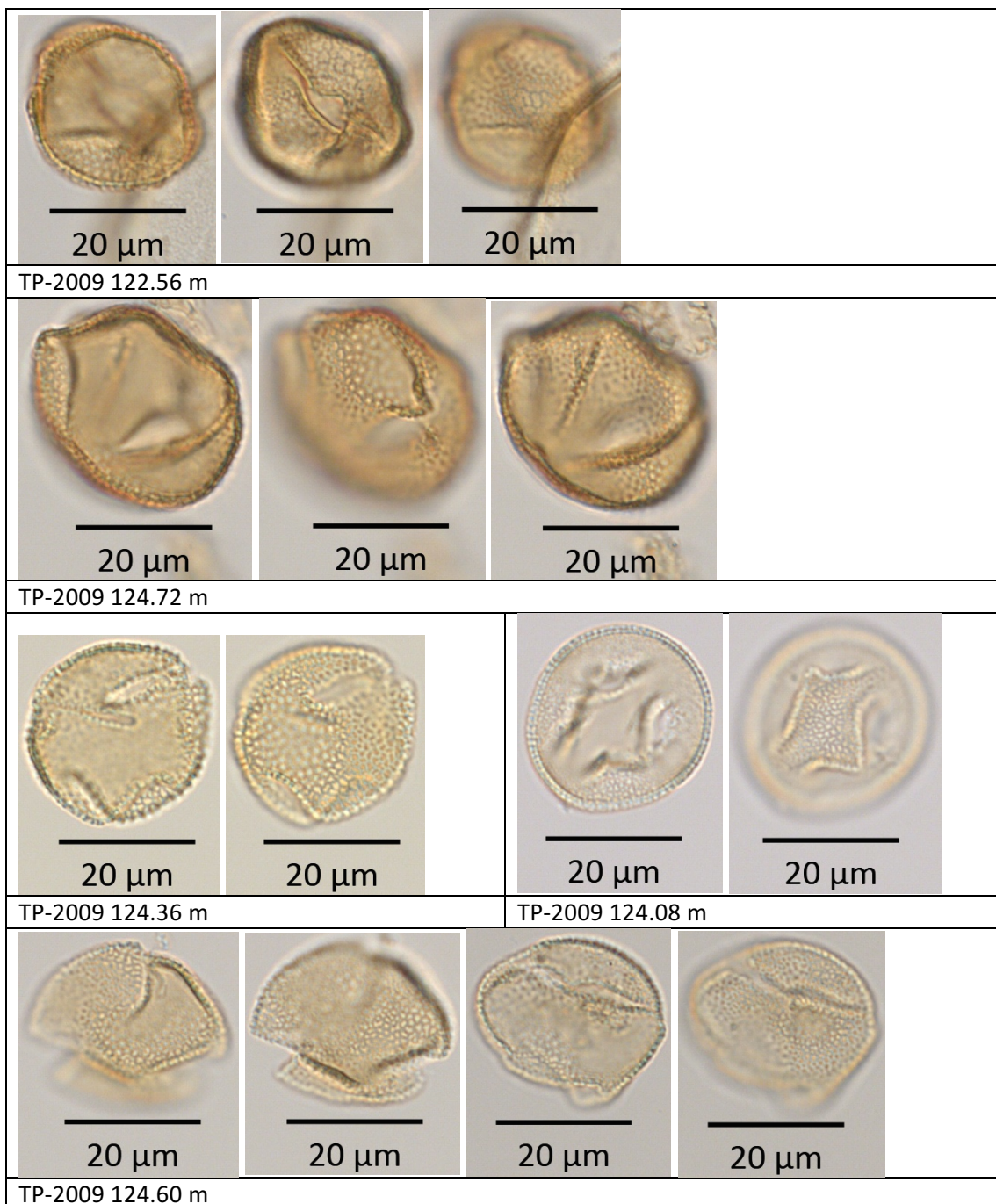
### Characteristics

<b>Pollen class</b>	Tricolporoidate
<b>Pollen grain shape</b>	Sphaeroid to prolate
<b>Pollen grain size</b>	35.4-57.0 µm
<b>Aperture</b>	Colpi eq. simple or s-shaped recessed (± not recessed)
<b>Sculpture</b>	Striate, striate-rugulate, valla 0.7-1.4 µm, meridional
<b>Sporoderm</b>	Exine 1.5-2.1 µm
<b>Ecology</b>	High abundances indicate water depth ca. 0.5-1 m (Harrison & Digerfeldt 1990)

# Tricolpatae

per-, supra- or microreticulate, fossulate



*Fraxinus excelsior* type**General remarks**

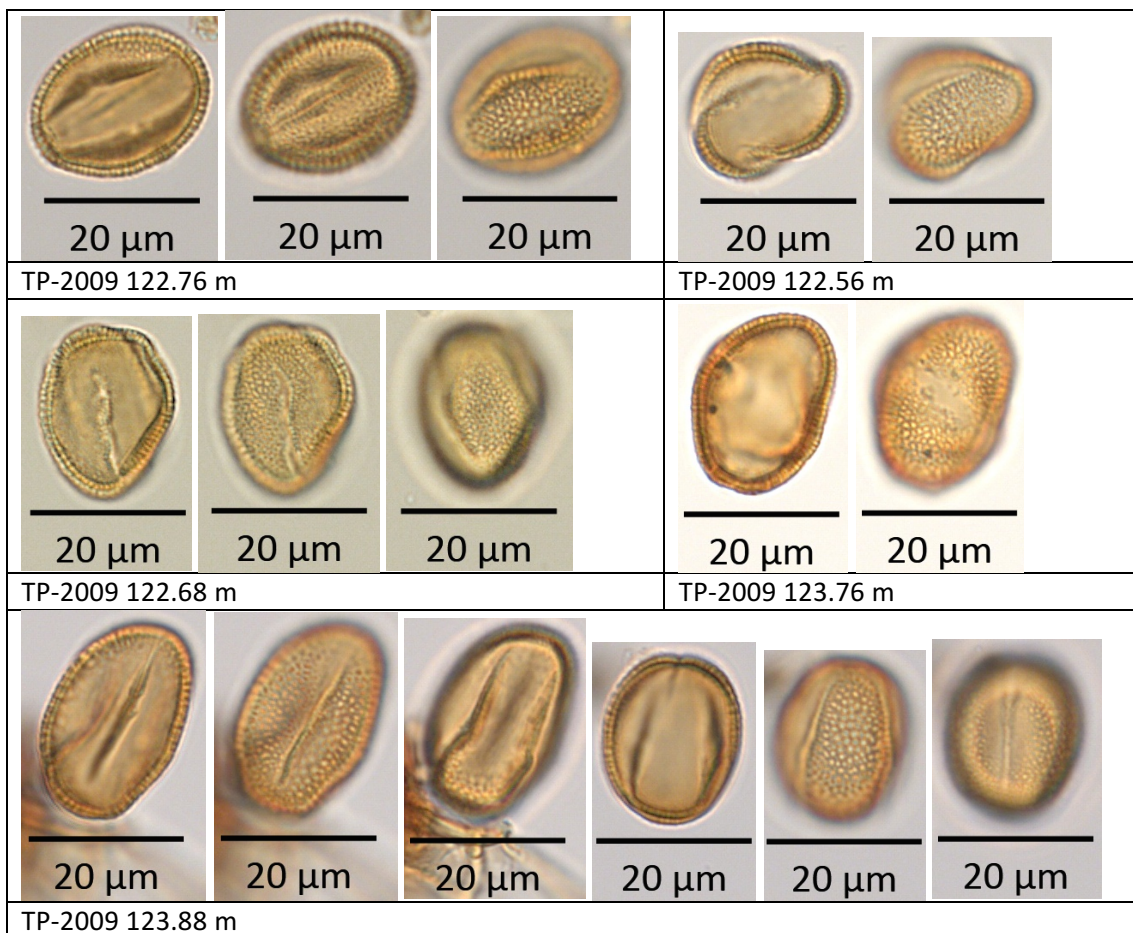
<b>Plant family</b>	Oleaceae
<b>Common names (English/German)</b>	European ash Gemeine Esche
<b>Palynomorph group</b>	Arboreal pollen
<b>Growth form</b>	Deciduous tree

**Characteristics**

<b>Pollen class</b>	Tricolpate
<b>Pollen grain shape</b>	Sphaeroid



<b>Pollen grain size</b>	19.5-29.5 $\mu\text{m}$
<b>Aperture</b>	Colpi recessed
<b>Sculpture</b>	Reticulate, brochi different sized, (0.6-)1.0-1.4(-2.0) $\mu\text{m}$
<b>Sporoderm</b>	Exine 1.0-1.2 $\mu\text{m}$

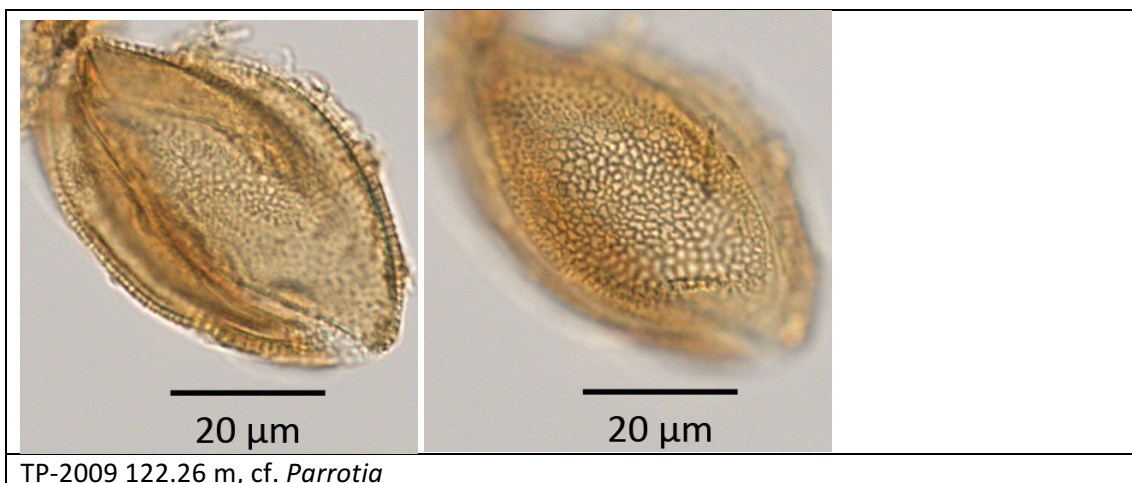
*Fraxinus ornus***General remarks**

<b>Plant family</b>	Oleaceae
<b>Common names (English/German)</b>	South European flowering ash Manna-Esche
<b>Palynomorph group</b>	Arboreal pollen
<b>Growth form</b>	Deciduous tree

**Characteristics**

<b>Pollen class</b>	Tricolpate
<b>Pollen grain shape</b>	Prolate or slightly sphaeroid
<b>Pollen grain size</b>	23.0-29.3 µm
<b>Aperture</b>	Colpi recessed
<b>Sculpture</b>	Reticulate, brochi 1.0-2.0(-2.2) µm, irregular
<b>Sporoderm</b>	Exine 2 µm, polar 2.2 µm

## *Parrotia*















### General remarks

<b>Plant family</b>	Hamamelidaceae
<b>Common names (English/German)</b>	Ironwood Eisenholzbäume
<b>Palynomorph group</b>	Arboreal pollen
<b>Growth form</b>	Deciduous tree or shrub

### Characteristics

<b>Pollen class</b>	Tricolpate
<b>Pollen grain shape</b>	Sphaeroid, poorly dimensionally stable
<b>Pollen grain size</b>	36.0-50.8 µm
<b>Aperture</b>	Colpi margins frayed
<b>Sculpture</b>	Reticulate, brochi 1.0-2.0 µm
<b>Sporoderm</b>	Exine 1.2-1.7 µm Columellae thin, indistinct

## *Phillyrea*

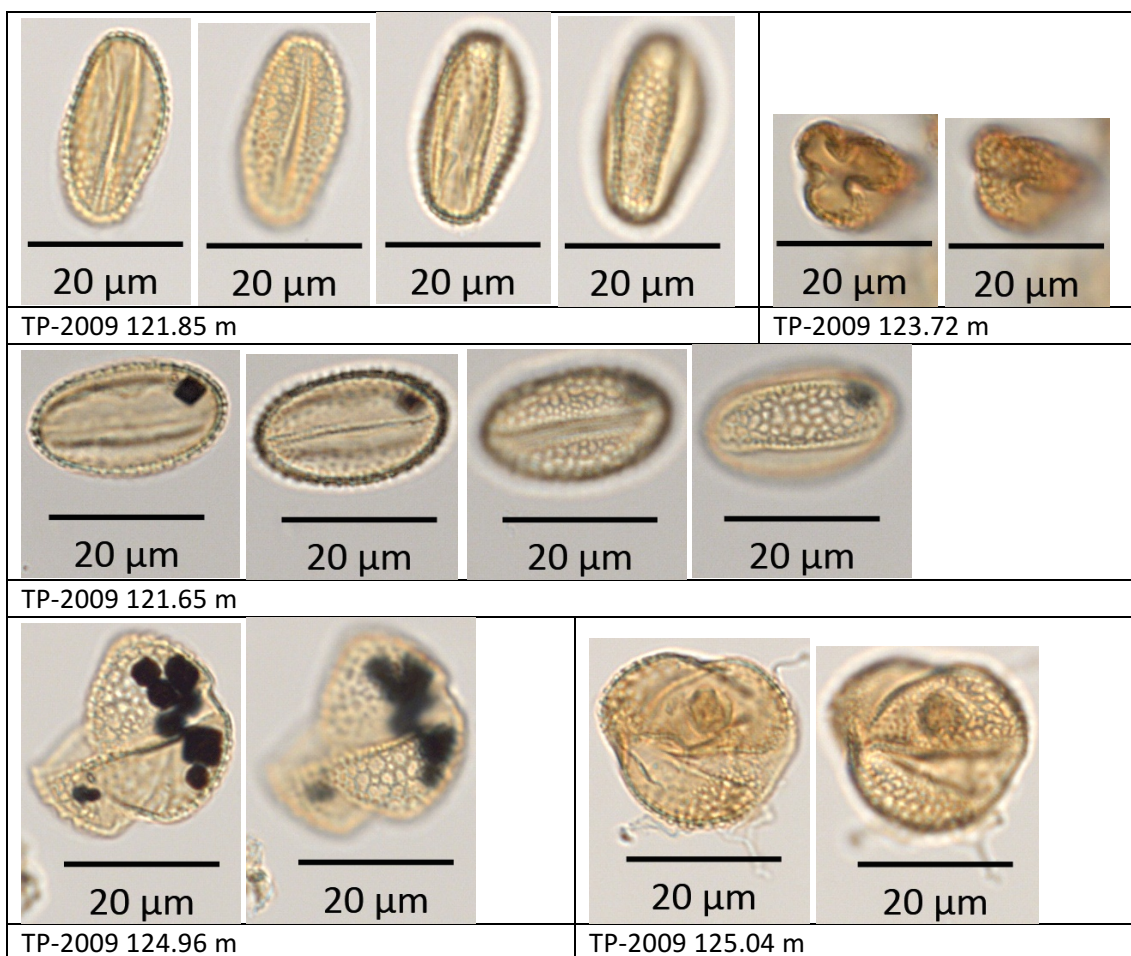
 20 μm	 20 μm	 20 μm	 20 μm	 20 μm
TP-2009 124.60 m		TP-2009 124.68 m		
 20 μm	 20 μm	 20 μm	 20 μm	
TP-2009 124.28 m		TP-2009 124.36 m		
 20 μm	 20 μm	 20 μm		
TP-2009 124.96 m				

### General remarks

<b>Plant family</b>	Oleaceae
<b>Common names (English/German)</b>	Phillyrea Steinlinden
<b>Palynomorph group</b>	Arboreal pollen
<b>Growth form</b>	Indeciduous shrub

### Characteristics

<b>Pollen class</b>	Tricolpate (± tetracolpate, pericolpate)
<b>Pollen grain shape</b>	Sphaeroid
<b>Pollen grain size</b>	18.2-30.0 µm
<b>Aperture</b>	Colpi thin, recessed
<b>Sculpture</b>	Reticulate, brochi 1.0-2.2 µm, irregular, elongated
<b>Sporoderm</b>	Exine (1.2-)1.4-2.0(-2.2) µm

*Salix***General remarks**

















<b>Plant family</b>	Salicaceae
<b>Common names (English/German)</b>	Willow Weiden
<b>Palynomorph group</b>	Arboreal pollen
<b>Growth form</b>	Deciduous tree or shrub

**Characteristics**

<b>Pollen class</b>	Tricolpate
<b>Pollen grain shape</b>	Prolate, mostly tapering
<b>Pollen grain size</b>	14.9-34.0 µm
<b>Aperture</b>	Colpi granulous
<b>Sculpture</b>	Reticulate, mostly homobrochate, brochi 2.8(-3.0) µm, microbrochi 0.6-1.2 µm if heterobrochate
<b>Sporoderm</b>	Exine 1.1-1.7 µm Columellae thin
<b>Ecology</b>	May indicate transitions from a cooler/drier to a warmer/wetter climate (van der Wiel & Wijmstra 1987)



*Tamarix*

					
TP-2009 123.76 m		TP-2009 126.36 m		TP-2009 121.41 m	
					
TP-2009 123.44 m			TP-2009 121.81 m		
					
TP-2009 124.04 m			TP-2009 125.68 m		

**General remarks**

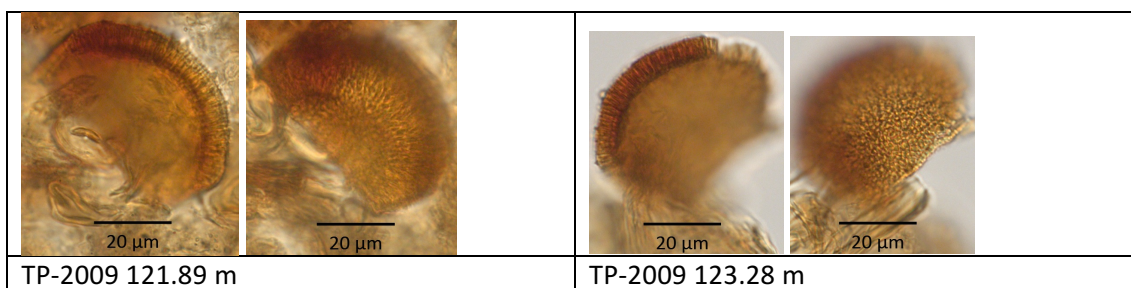
<b>Plant family</b>	Tamaricaceae
<b>Common names (English/German)</b>	Tamarisk, salt cedar Tamarisken
<b>Palynomorph group</b>	Arboreal pollen
<b>Growth form</b>	Deciduous tree or shrub

**Characteristics**

<b>Pollen class</b>	Tricolpate
<b>Pollen grain shape</b>	Sphaeroid to slightly prolate
<b>Pollen grain size</b>	15.0-20.0 µm
<b>Aperture</b>	Colpi long
<b>Sculpture</b>	Reticulate, homobrochate, brochi 0.5-2.0 µm, irregular
<b>Sporoderm</b>	Exine 1.5-1.8 µm Columellae distinct



## Armeria




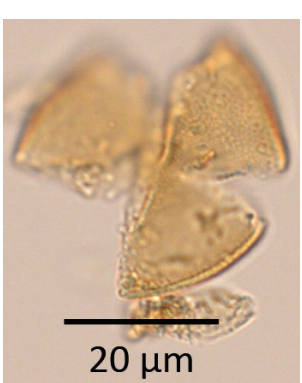

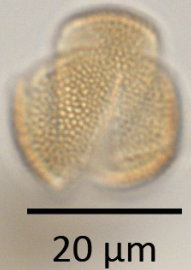

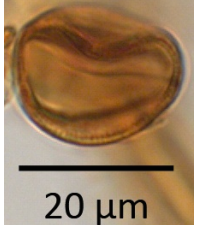
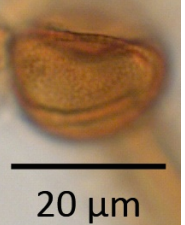

### General remarks

<b>Plant family</b>	Plumbaginaceae
<b>Common names (English/German)</b>	Lady's cushion Grasnelken
<b>Palynomorph group</b>	Non-arboreal pollen
<b>Growth form</b>	Herbaceous perennials

### Characteristics

<b>Pollen class</b>	Tricolpate
<b>Pollen grain shape</b>	60.8-76.8 µm
<b>Pollen grain size</b>	Sphaeroid
<b>Aperture</b>	
<b>Sculpture</b>	Pollendimorph, linked to flower dimorphism; largereticolate PG with 15 µm long brochi and muri with 1.0-2.0 µm long echini; smallreticolate PG with 2.5-6.0 µm long brochi and muri with 0.9-1.2 µm long echini
<b>Sporoderm</b>	Largereticolate PG: exine 9-12 µm Smallreticolate PG: exine 3-8 µm
<b>Remarks</b>	<i>Limonium</i> : smaller, shorter brochi, thinner exine

**Ballota type**

							
TP-2009 122.00 m		TP-2009 124.80 m		TP-2009 124.28 m		TP-2009 123.68 m	
							
TP-2009 124.28 m		TP-2009 123.68 m		TP-2009 120.76 m		TP-2009 120.76 m	

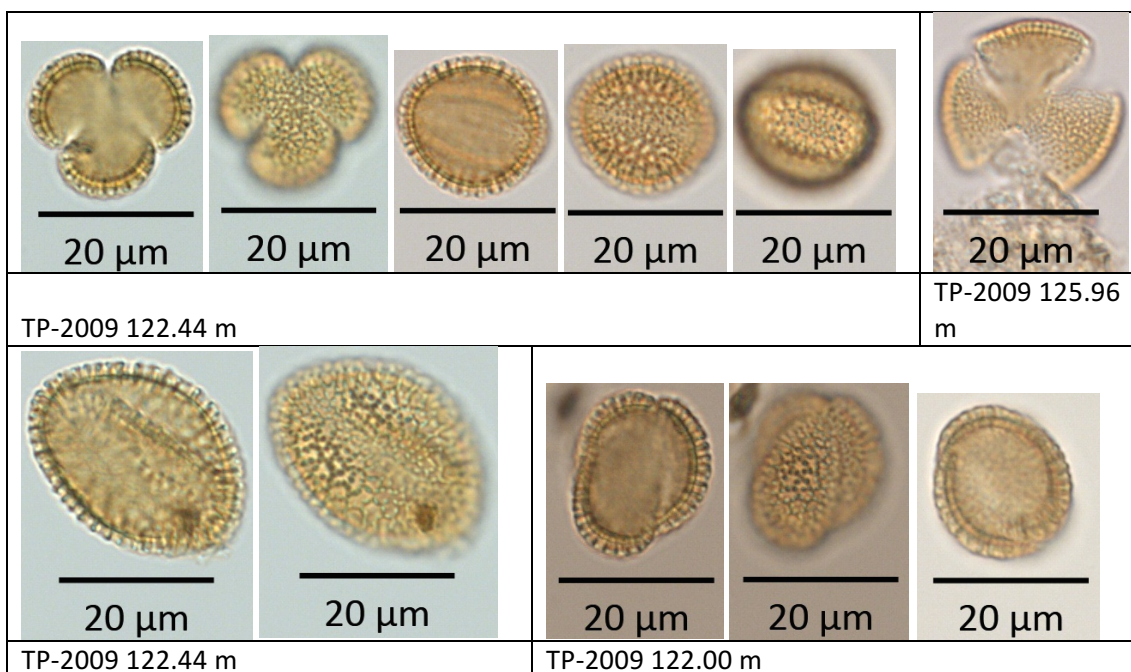
**General remarks**

<b>Plant family</b>	Lamiaceae
<b>Common names (English/German)</b>	Milkvetch, locoweed, goat's-thorn Schwarznesseln
<b>Palynomorph group</b>	Non-arboreal pollen
<b>Growth form</b>	Herbaceous perennials or shrubs

**Characteristics**

<b>Pollen class</b>	Tricolpate
<b>Pollen grain shape</b>	Sphaeroid to prolate, eq. elliptic to spindle-shaped or rhomboid
<b>Pollen grain size</b>	17.8-38.0 µm
<b>Aperture</b>	Intercolpium margins frayed
<b>Sculpture</b>	Reticulate, brochi max. 1(-1.2) µm, no microbrochi
<b>Sporoderm</b>	Exine 1.5-2.0 µm, polar and subpolar thicker than eq.

## Brassicaceae (= Cruciferae)

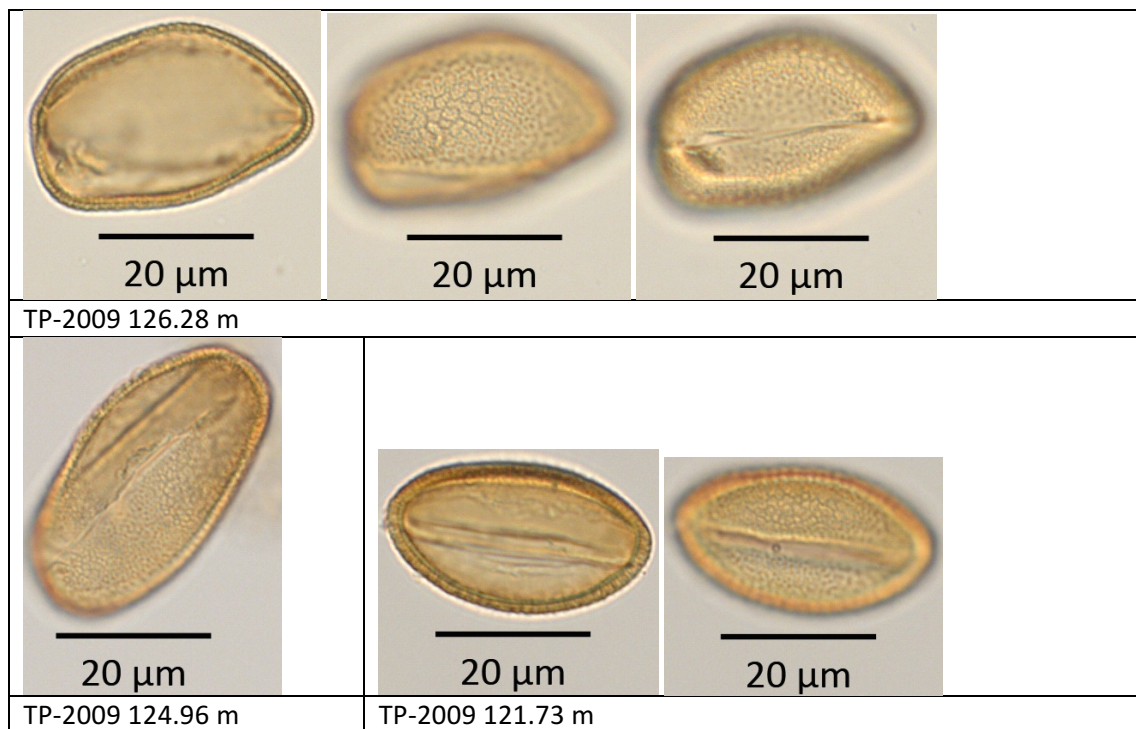


### General remarks

<b>Plant family</b>	Brassicaceae
<b>Common names (English/German)</b>	Crucifers or cabbage family Kreuzblütler
<b>Palynomorph group</b>	Non-arboreal pollen
<b>Growth form</b>	Herbaceous perennials to annuals

### Characteristics

<b>Pollen class</b>	Tricolpate, tetracolpate, pericolpate, inaperturate
<b>Pollen grain shape</b>	Sphaeroid to prolate
<b>Pollen grain size</b>	13.0-45.4 µm
<b>Aperture</b>	Colpi thin, long, recessed
<b>Sculpture</b>	Perreticulate, brochi (0.8-)1.0-4.5 µm
<b>Sporoderm</b>	Exine 1.0-3.5 µm
<b>Remarks</b>	<i>Tamarix</i> : microreticulate margins <i>Olea</i> : midsize polar fields

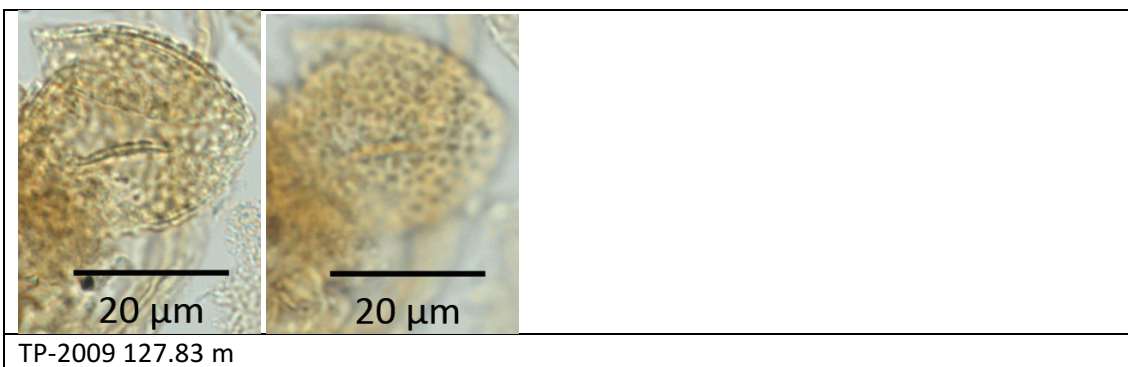
***Galeopsis* type****General remarks**

<b>Plant family</b>	Lamiaceae
<b>Common names (English/German)</b>	Hemp-nettle Hohlzahn
<b>Palynomorph group</b>	Non-arboreal pollen
<b>Growth form</b>	Herbaceous annuals

**Characteristics**

<b>Pollen class</b>	Tricolpate
<b>Pollen grain shape</b>	Sphaeroid to prolate, eq. elliptic to spindle-shaped or rhomboid
<b>Pollen grain size</b>	17.7-54.8 µm
<b>Aperture</b>	Intercolpium margins frayed
<b>Sculpture</b>	Reticulate, brochi max. 2.5(-3) µm, 2-3(>3) microbrochi in a lumen
<b>Sporoderm</b>	Exine 1.5-2.0 µm, polar and subpolar thicker than eq.

### *Helleborus viridis* type



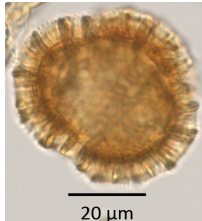





#### General remarks

<b>Plant family</b>	Ranunculaceae
<b>Common names (English/German)</b>	Hellebore Nieswurz
<b>Palynomorph group</b>	Non-arboreal pollen
<b>Growth form</b>	Herbaceous perennials

#### Characteristics

<b>Pollen class</b>	Tricolpate ( $\pm$ pericolpate)
<b>Pollen grain shape</b>	Sphaeroid
<b>Pollen grain size</b>	30.5-46.1 $\mu\text{m}$
<b>Aperture</b>	Colpi max. 6 $\mu\text{m}$ broad
<b>Sculpture</b>	Reticulate, brochi 1-4 $\mu\text{m}$
<b>Sporoderm</b>	Exine (1.8-)2.0-2.5 $\mu\text{m}$ Columellae distinct

## *Limonium*

 		 	
TP-2009 121.25 m		TP-2009 122.44 m	
 			
TP-2009 124.52 m			

### General remarks

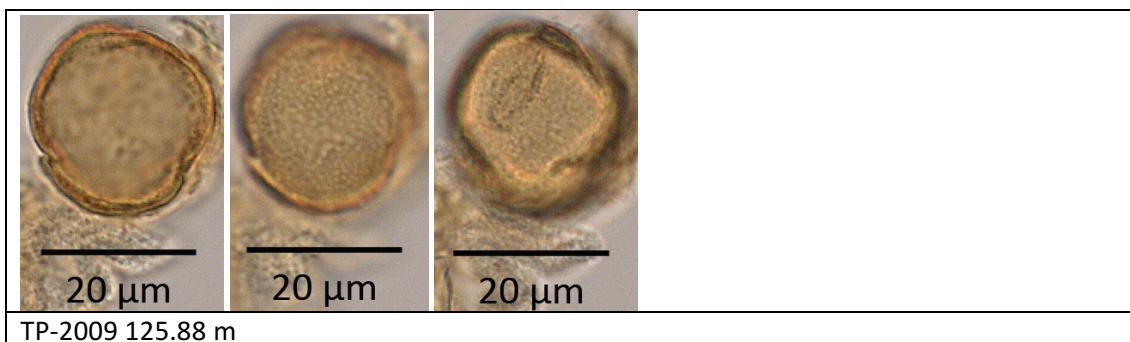
<b>Plant family</b>	Plumbaginaceae
<b>Common names (English/German)</b>	Sea lavender Strandflieder
<b>Palynomorph group</b>	Non-arboreal pollen
<b>Growth form</b>	Herbaceous perennials (± annuals)

### Characteristics

<b>Pollen class</b>	Tricolpate
<b>Pollen grain shape</b>	Sphaeroid
<b>Pollen grain size</b>	46.0-56.8 µm
<b>Aperture</b>	
<b>Sculpture</b>	Pollendimorphism, linked to flower dimorphism; largereticulate PG with 7-9 µm long brochi and muri with 1.0-2.0 µm long echini; small-reticulate PG with 1.5-3.5 µm long brochi and muri scabrate
<b>Sporoderm</b>	Largereticulate PG: exine 8-9 µm Smallreticulate PG: exine 5-6 µm
<b>Remarks</b>	<i>Armeria</i> : larger, longer brochi, thicker exine



## Odontites type













### General remarks

<b>Plant family</b>	Orobanchaceae
<b>Common names (English/German)</b>	Bartsia Zahntroste
<b>Palynomorph group</b>	Non-arboreal pollen
<b>Growth form</b>	Herbaceous annuals (± perennials and lignifying)

### Characteristics

<b>Pollen class</b>	Tricolpate (± pericolpate, tetracolpate)
<b>Pollen grain shape</b>	Sphaeroid, polar triangular
<b>Pollen grain size</b>	21.8-35.5 µm
<b>Aperture</b>	Colpi long and thin, ± granulous Intercolpi with 10 µm large, rounded and not sculptured region
<b>Sculpture</b>	Microreticulate
<b>Sporoderm</b>	Exine 1.5 µm Endexine thinner than ectexine
<b>Remarks</b>	<i>Melampyrum</i> : psilate

***Oxalis stricta* type**

 20 μm		 20 μm		 20 μm		 20 μm					
TP-2009 125.88 m				TP-2009 124.88 m							
 20 μm		 20 μm		 20 μm		 20 μm		 20 μm		 20 μm	
TP-2009 122.26 m				TP-2009 123.08 m				TP-2009 123.08 m			

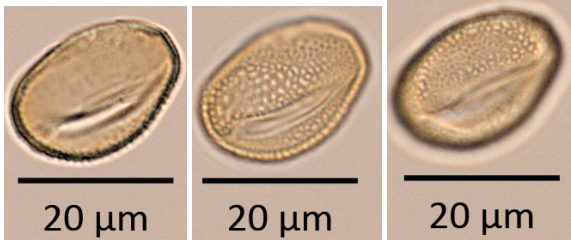
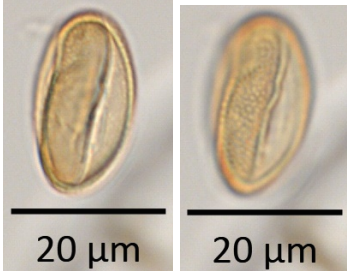
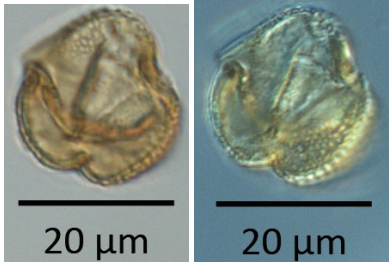
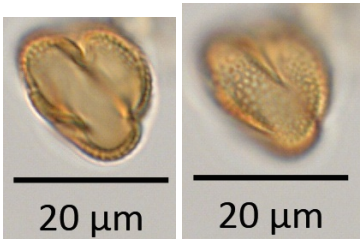
**General remarks**

<b>Plant family</b>	Oxalidaceae
<b>Common names (English/German)</b>	Common yellow woodsorrel Aufrechter Sauerklee
<b>Palynomorph group</b>	Non-arboreal pollen
<b>Growth form</b>	Herbaceous perennials or annuals

**Characteristics**

<b>Pollen class</b>	Tricolpate
<b>Pollen grain shape</b>	Sphaeroid, globose to slightly elongated
<b>Pollen grain size</b>	23.5-42.0 µm
<b>Aperture</b>	Colpi 2.5-5.0 µm broad, scabrate or cloddy
<b>Sculpture</b>	Reticulate, brochi 2.0-2.2 µm
<b>Sporoderm</b>	Exine (1.5-)1.8-2.2 µm

***Saxifraga stellaris* type**

				
TP-2009 121.41 µm			TP-2009 124.72 m	
				
TP-2009 122.64 m			TP-2009 121.85 m	

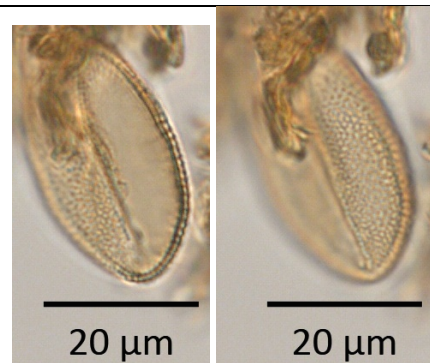
**General remarks**

<b>Plant family</b>	Saxifragaceae
<b>Common names (English/German)</b>	Starry saxifrage Stern-Steinbrech
<b>Palynomorph group</b>	Non-arboreal pollen
<b>Growth form</b>	Herbaceous perennials

**Characteristics**

<b>Pollen class</b>	Tricolpate
<b>Pollen grain shape</b>	Prolate ( $\pm$ sphaeroid), polar tapered
<b>Pollen grain size</b>	14.2-23.3 µm
<b>Aperture</b>	
<b>Sculpture</b>	Reticulate, brochi 0.5-1.2(-1.8) µm
<b>Sporoderm</b>	Exine (1.0-)1.2-1.8 µm Columellae not visible

### *Stachys* (in *Galeopsis-Ballota* group)



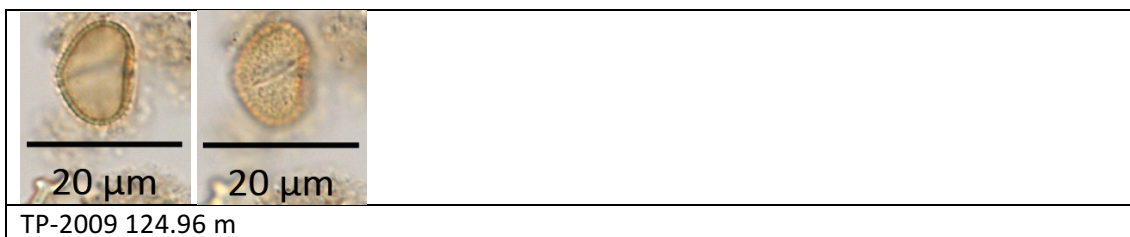
TP-2009 125.72 m

#### General remarks

<b>Plant family</b>	Lamiaceae
<b>Common names (English/German)</b>	Heal-all Zieste
<b>Palynomorph group</b>	Non-arboreal pollen
<b>Growth form</b>	Herbaceous perennials or annuals ( $\pm$ subshrubs or shrubs)

#### Characteristics

<b>Pollen class</b>	Tricolpate
<b>Pollen grain shape</b>	Sphaeroid to prolate, eq. elliptic to spindle-shaped or rhomboid
<b>Pollen grain size</b>	30.8-41.0 $\mu\text{m}$
<b>Aperture</b>	Intercolpium margins frayed
<b>Sculpture</b>	Reticulate, brochi max. 2.5(-3) $\mu\text{m}$ , 2-3(>3) microbrochi in a lumen
<b>Sporoderm</b>	Exine 1.5-2.0 $\mu\text{m}$ , polar and subpolar thicker than eq.

***Hottonia*****General remarks**

<b>Plant family</b>	Primulaceae
<b>Common names (English/German)</b>	Wasserfedern
<b>Palynomorph group</b>	<a href="#">Aquatic</a>
<b>Growth form</b>	Hydrophyte, herbaceous perennials

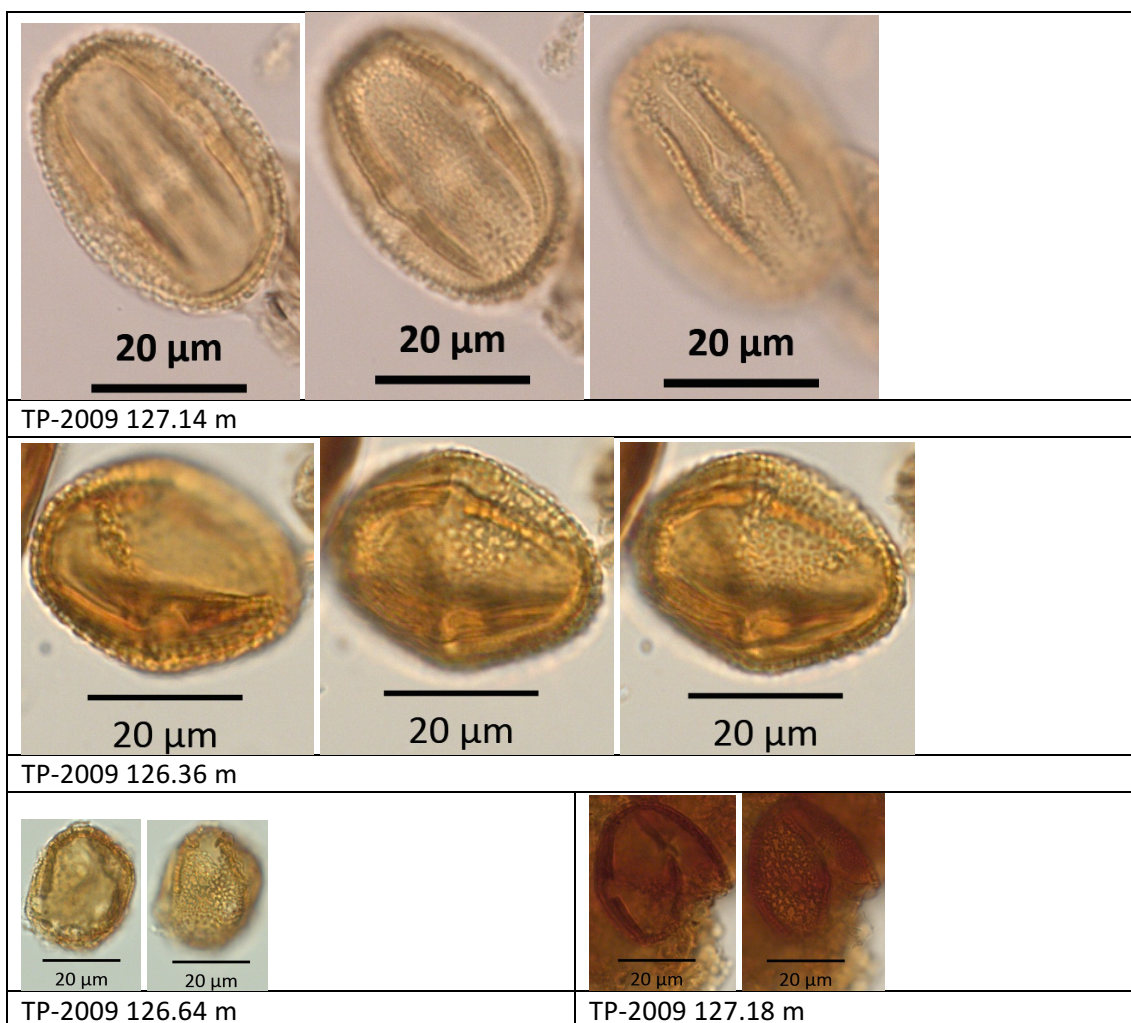
**Characteristics**

<b>Pollen class</b>	Tricolpate
<b>Pollen grain shape</b>	Sphaeroid ( $\pm$ slightly prolate)
<b>Pollen grain size</b>	Heterostylous: small (10.6-14.5 $\mu\text{m}$ ) and large PG (17.7-21.6 $\mu\text{m}$ )
<b>Aperture</b>	
<b>Sculpture</b>	Reticulate, brochi max. 1 $\mu\text{m}$ (small PG) or max. 1.2(-1.5) $\mu\text{m}$ (large PG)
<b>Sporoderm</b>	Exine max. 1 $\mu\text{m}$ (small PG) or max. 1.2 $\mu\text{m}$ (large PG) Columellae not visible

# Tricolporatae

per-, supra- or microreticulate, fossulate

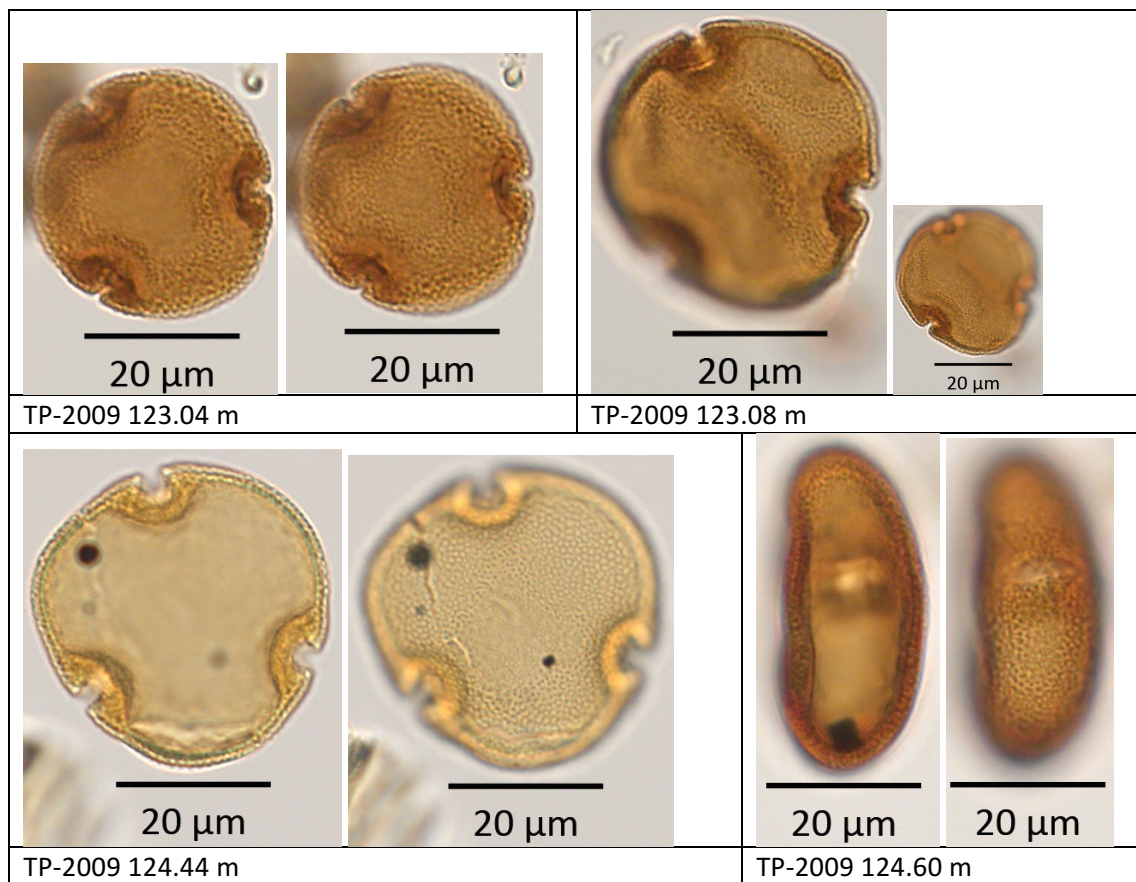


*Hedera helix***General remarks**

<b>Plant family</b>	Araliaceae
<b>Common names (English/German)</b>	South European flowering ash Efeu
<b>Palynomorph group</b>	Arboreal pollen
<b>Growth form</b>	Deciduous creeper

**Characteristics**

<b>Pollen class</b>	Tricolporate
<b>Pollen grain shape</b>	Sphaeroid to slightly prolate, eq. elliptic to barrel-shaped, polar field flattened
<b>Pollen grain size</b>	31.9-42.1 µm
<b>Aperture</b>	Pori eq. elongated, rectangular, 4-5.5 x 9.5-11 µm Intercolpi concave or flattened
<b>Sculpture</b>	Reticulate, heterobrochate, large brochi 2-5 µm, small brochi 1.0-1.5 µm
<b>Sporoderm</b>	Exine 1.9-2.2 µm

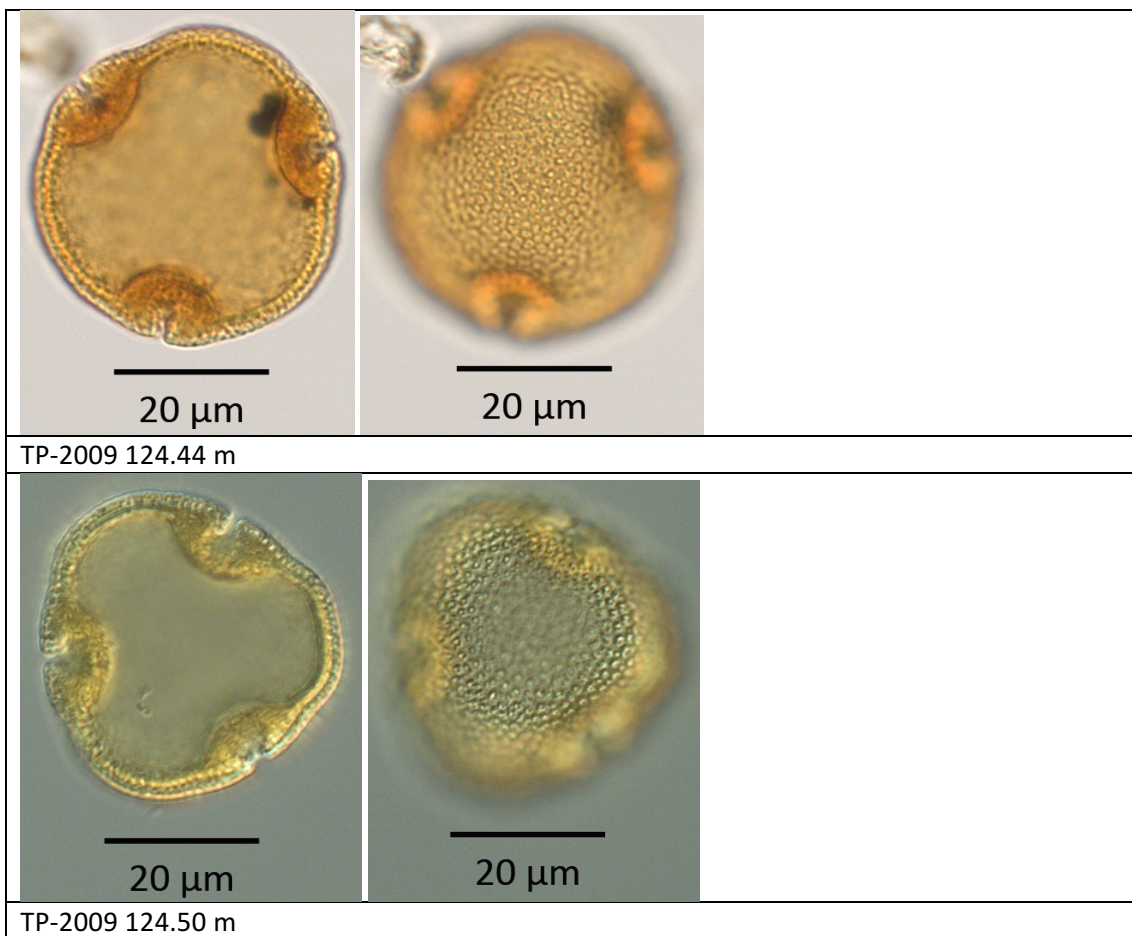
*Tilia cordata* type**General remarks**

<b>Plant family</b>	Malvaceae
<b>Common names (English/German)</b>	Small-leaved lime Winterlinde
<b>Palynomorph group</b>	Arboreal pollen
<b>Growth form</b>	Deciduous tree

**Characteristics**

<b>Pollen class</b>	Tricolporate
<b>Pollen grain shape</b>	Oblate to peroblate, polar circular
<b>Pollen grain size</b>	29.0-49.4 µm
<b>Aperture</b>	Pori 4.5-7.0 µm Colpi 9.5-11.0 µm short
<b>Sculpture</b>	Reticulate, slightly heteropolar, flatter polar field finer granulous
<b>Sporoderm</b>	Exine 1.8-2.5 µm
<b>Ecology</b>	One of the most drought-resitant trees of non-Mediterranean Europe, but was not observed to grow higher than 0.4-0.5 m, although the individuals were 20 yrs and older (Pigott & Pigott 1993, Tinner & Lotter 2001)

***Tilia platyphyllos* type**








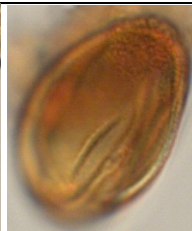
**General remarks**

<b>Plant family</b>	Malvaceae
<b>Common names (English/German)</b>	Large-leaved lime Sommerlinde
<b>Palynomorph group</b>	Arboreal pollen
<b>Growth form</b>	Deciduous tree

**Characteristics**

<b>Pollen class</b>	Tricolporate
<b>Pollen grain shape</b>	Oblate to peroblate, polar circular
<b>Pollen grain size</b>	29.1-49.2 µm
<b>Aperture</b>	Pori 4.5-7.0 µm Colpi 9.5-11.0 µm short
<b>Sculpture</b>	Reticulate, distinct heteropolar, flatter polar field finer granulous
<b>Sporoderm</b>	Exine 1.8-2.5 µm

**Vitis**

 		 	
TP-2009 125.76 m		TP-2009 126.16 m	
 			
TP-2009 127.18 m			

**General remarks**

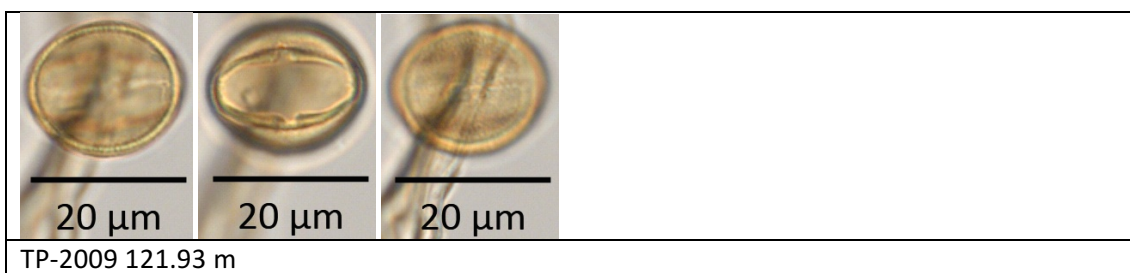
<b>Plant family</b>	Vitaceae
<b>Common names (English/German)</b>	Grapevines Weinreben
<b>Palynomorph group</b>	Arboreal pollen
<b>Growth form</b>	Deciduous or indeciduous shrubs or creeper

**Characteristics**

<b>Pollen class</b>	Tricolporate
<b>Pollen grain shape</b>	Sphaeroid ( $\pm$ slightly prolate), eq. elliptic, polar flattened or apiculate
<b>Pollen grain size</b>	20.5-28.3 $\mu\text{m}$
<b>Aperture</b>	Pori 2.0-2.5 $\mu\text{m}$ , circular ( $\pm$ slightly elliptic) Colpi with margins Intercolpi concave
<b>Sculpture</b>	Polar reticulate or microreticulate, brochi 0.5-1.2(-2.0) $\mu\text{m}$ , irregular
<b>Sporoderm</b>	Exine 1.3-2.0 $\mu\text{m}$



### *Anagallis* type

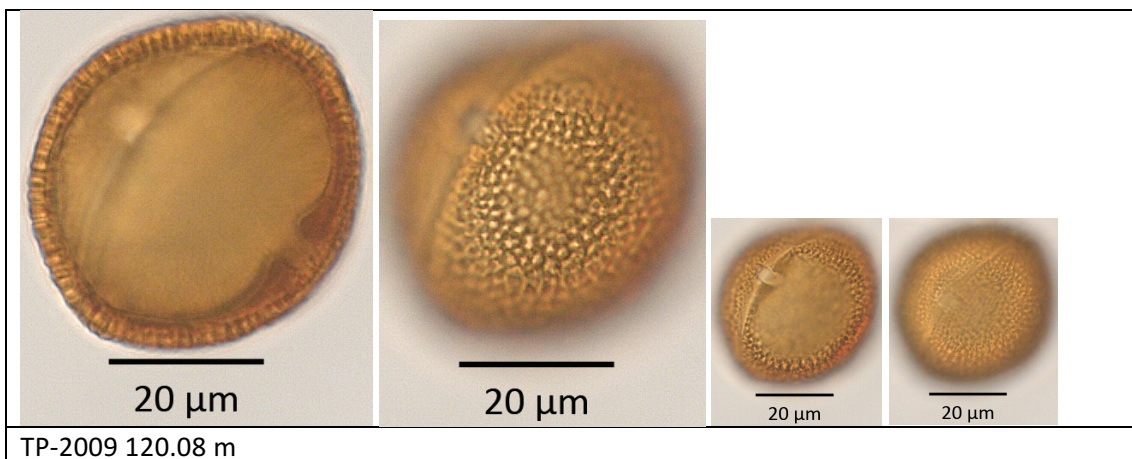


#### General remarks

<b>Plant family</b>	Primulaceae
<b>Common names (English/German)</b>	Pimpernel Gauchheil
<b>Palynomorph group</b>	Non-arboreal pollen
<b>Growth form</b>	Herbaceous perennials to annuals

#### Characteristics

<b>Pollen class</b>	Tricolporate
<b>Pollen grain shape</b>	Sphaeroid to prolate, eq. elliptic
<b>Pollen grain size</b>	16.1-34.5 µm
<b>Aperture</b>	Pori eq. elongated, 2-4 µm broad, tapered, pori associated to cingulum Colpi with costae
<b>Sculpture</b>	Reticulate, brochi 1 µm
<b>Sporoderm</b>	Exine 1.5-2.0 µm Columellae not visible

***Cistus*****General remarks**

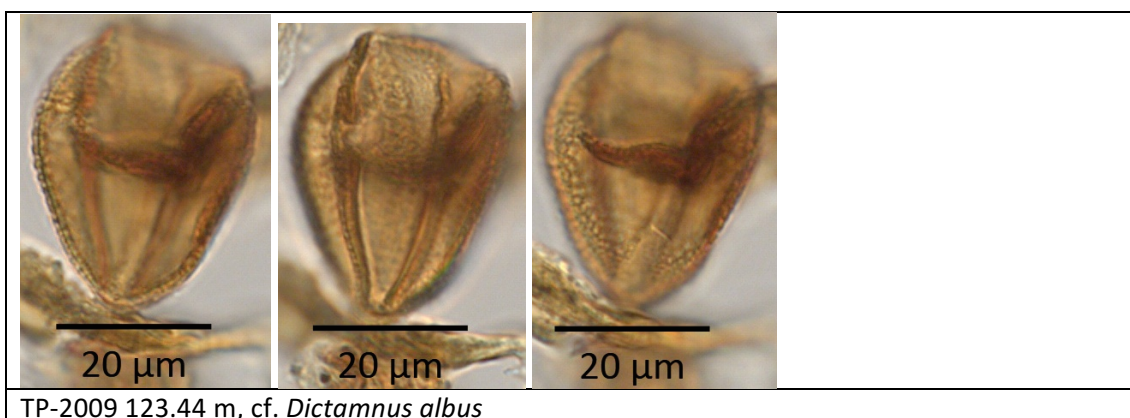
<b>Plant family</b>	Cistaceae
<b>Common names (English/German)</b>	Rockrose Zistrosen
<b>Palynomorph group</b>	Non-arboreal pollen
<b>Growth form</b>	Indeciduous shrub

**Characteristics**

<b>Pollen class</b>	Tricolporate
<b>Pollen grain shape</b>	Sphaeroid, rounded to slightly apiculate
<b>Pollen grain size</b>	38.0-54.5 µm
<b>Aperture</b>	Pori circular(5-9 µm), meridional elongated (3-6 x 6-10 µm) or eq. elongated (6-7 x 5 µm)
<b>Sculpture</b>	Reticulate-echinate, reticulate-scabrate, reticulate-striate, brochi 1.0-3.5 µm, muri echinate or scabrate, 0.8-1.3 µm broad
<b>Sporoderm</b>	Exine /w echini 2.0-4.5 µm Columellae distinct, max. 1 µm



## *Dictamnus albus*



TP-2009 123.44 m, cf. *Dictamnus albus*

### General remarks

<b>Plant family</b>	Rutaceae
<b>Common names (English/German)</b>	Burning bush, false dittany, gas plant, Fraxinella Diptam, Aschwurz, Brennender Busch
<b>Palynomorph group</b>	Non-arboreal pollen
<b>Growth form</b>	Herbaceous perennials

### Characteristics

<b>Pollen class</b>	Tricolporate
<b>Pollen grain shape</b>	Prolate to slightly sphaeroid, rhomboid
<b>Pollen grain size</b>	34.7-40.7 µm
<b>Aperture</b>	Pori slit-shaped, 9 x 2 µm, margins often irregular Intercolpium margins recessed
<b>Sculpture</b>	Perreticulate to slightly reticulate-striate, brochi 1-1.5 µm, brochi polar and subpolar smaller (1.0 µm)
<b>Sporoderm</b>	Exine 2 µm Columellae indistinct

## Fabaceae p.p.



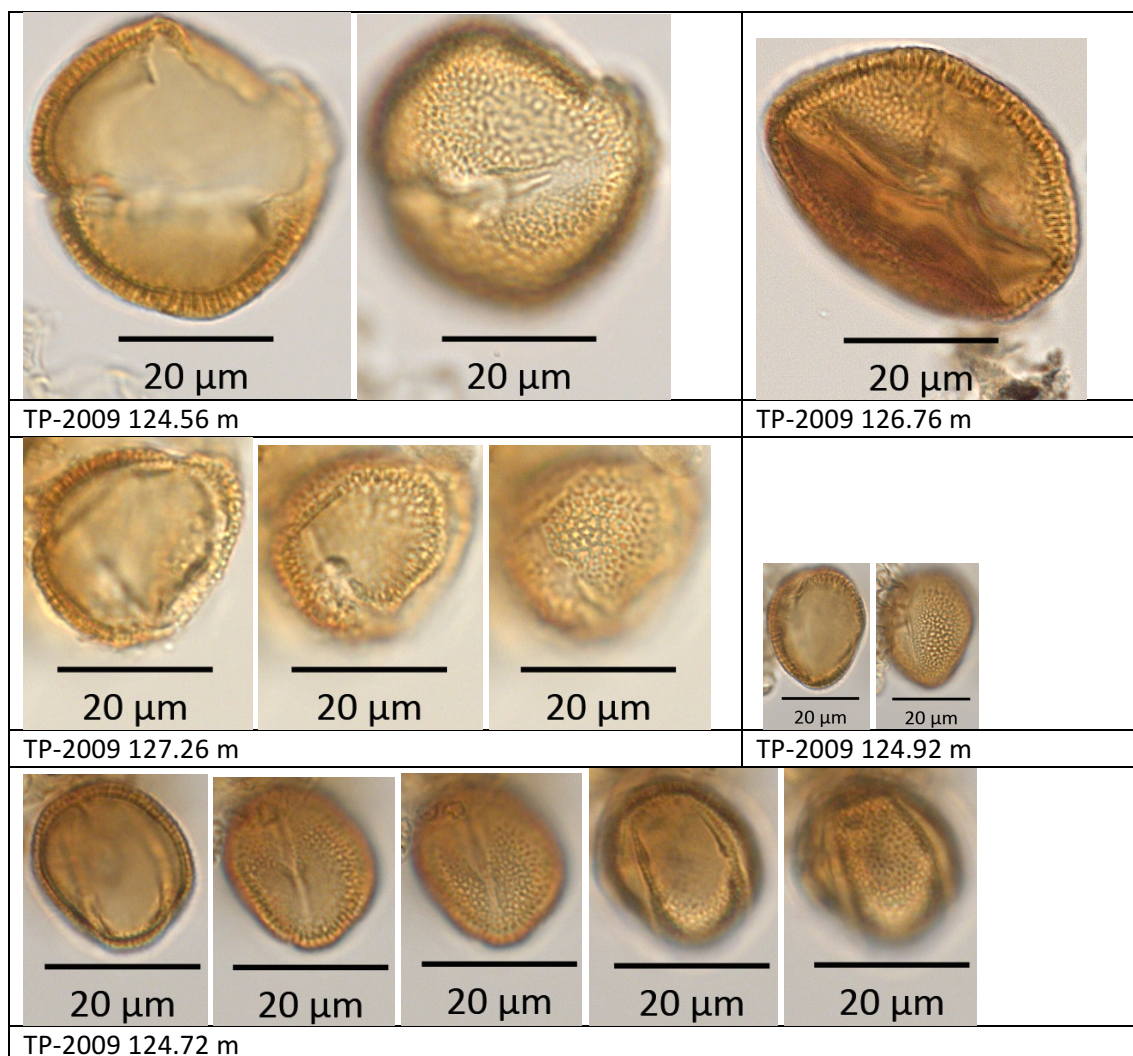
### General remarks

<b>Plant family</b>	Fabaceae
<b>Common names (English/German)</b>	Legume, pea or bean family Hülsenfrüchtler
<b>Palynomorph group</b>	Non-arboreal pollen
<b>Growth form</b>	Herbaceous perennials, biennials or annuals, trees or shrubs

### Characteristics

<b>Pollen class</b>	Tricolporate
<b>Pollen grain shape</b>	Prolate ( $\pm$ elliptic, rectangular)
<b>Pollen grain size</b>	15.5-72.0 $\mu\text{m}$
<b>Aperture</b>	Pori 3-9 $\mu\text{m}$ , circular ( $\pm$ elliptic, butterfly-like), with costae Colpi with costae or margo, brochi 1-1.5(-5) $\mu\text{m}$
<b>Sculpture</b>	Suprareticulate ( $\pm$ scabrate, rugulate, psilate)
<b>Sporoderm</b>	Exine 1.0-2.0 $\mu\text{m}$

### *Gentianella germanica* type



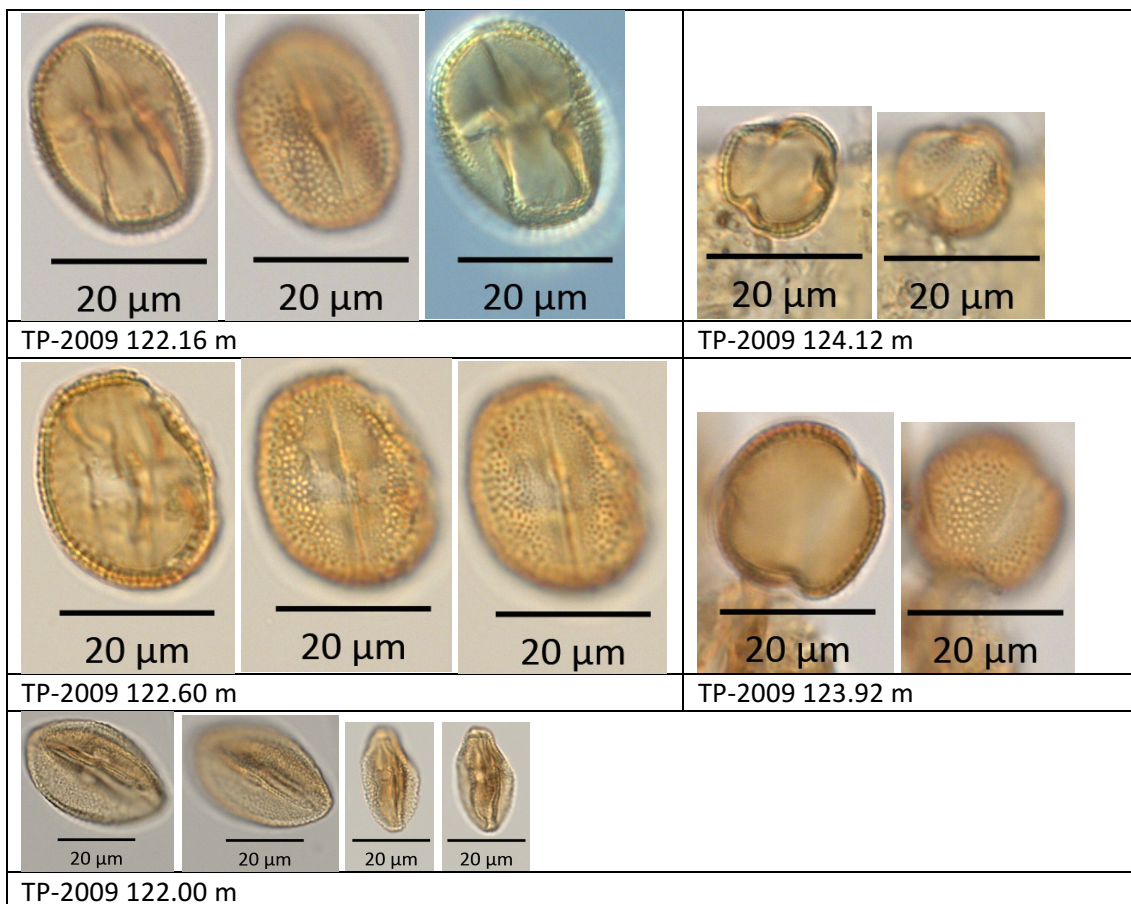
#### General remarks

<b>Plant family</b>	Gentianaceae
<b>Common names (English/German)</b>	Chiltern gentian Deutscher Fransenenzian
<b>Palynomorph group</b>	Non-arboreal pollen
<b>Growth form</b>	Herbaceous annuals or biennials

#### Characteristics

<b>Pollen class</b>	Tricolporate
<b>Pollen grain shape</b>	Sphaeroid to prolate, eq. globose to elliptic or slightly rhomboid
<b>Pollen grain size</b>	31.5-64.0 µm
<b>Aperture</b>	Pori meridional elongated, 4-5 x 8-9 µm Colpi with margo
<b>Sculpture</b>	Perreticulate, brochi 1.0-3.5 µm, muri 0.8 µm broad
<b>Sporoderm</b>	Exine 2.0-4.0 µm Columellae max. 1 µm thick and 1.5-2.0 µm high

*Lysimachia vulgaris* type



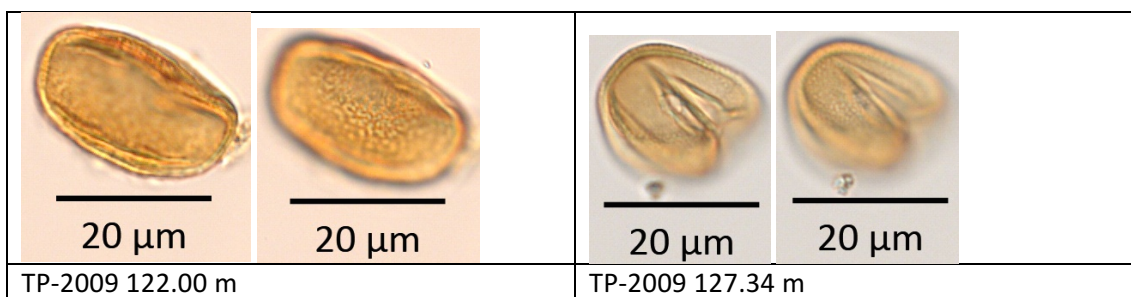
**General remarks**

<b>Plant family</b>	Primulaceae
<b>Common names (English/German)</b>	Garden Loosestrife Gewöhnlicher Gilbweiderich
<b>Palynomorph group</b>	Non-arboreal pollen
<b>Growth form</b>	Herbaceous perennials

**Characteristics**

<b>Pollen class</b>	Tricolporate, tetracolporate
<b>Pollen grain shape</b>	Sphaeroid to prolate, eq. elliptic, margins parallel, often deformed
<b>Pollen grain size</b>	13.0-32.2 µm
<b>Aperture</b>	Pori eq. elongated, tapering, irregular, 12 x 4 µm (± slit-shaped, than 2 µm broad) Colpi with costae
<b>Sculpture</b>	Reticulate, brochi 1-2(-3) µm, muri 0.8 µm broad
<b>Sporoderm</b>	Exine 1.0-1.8 µm Columellae short

## *Ononis* type



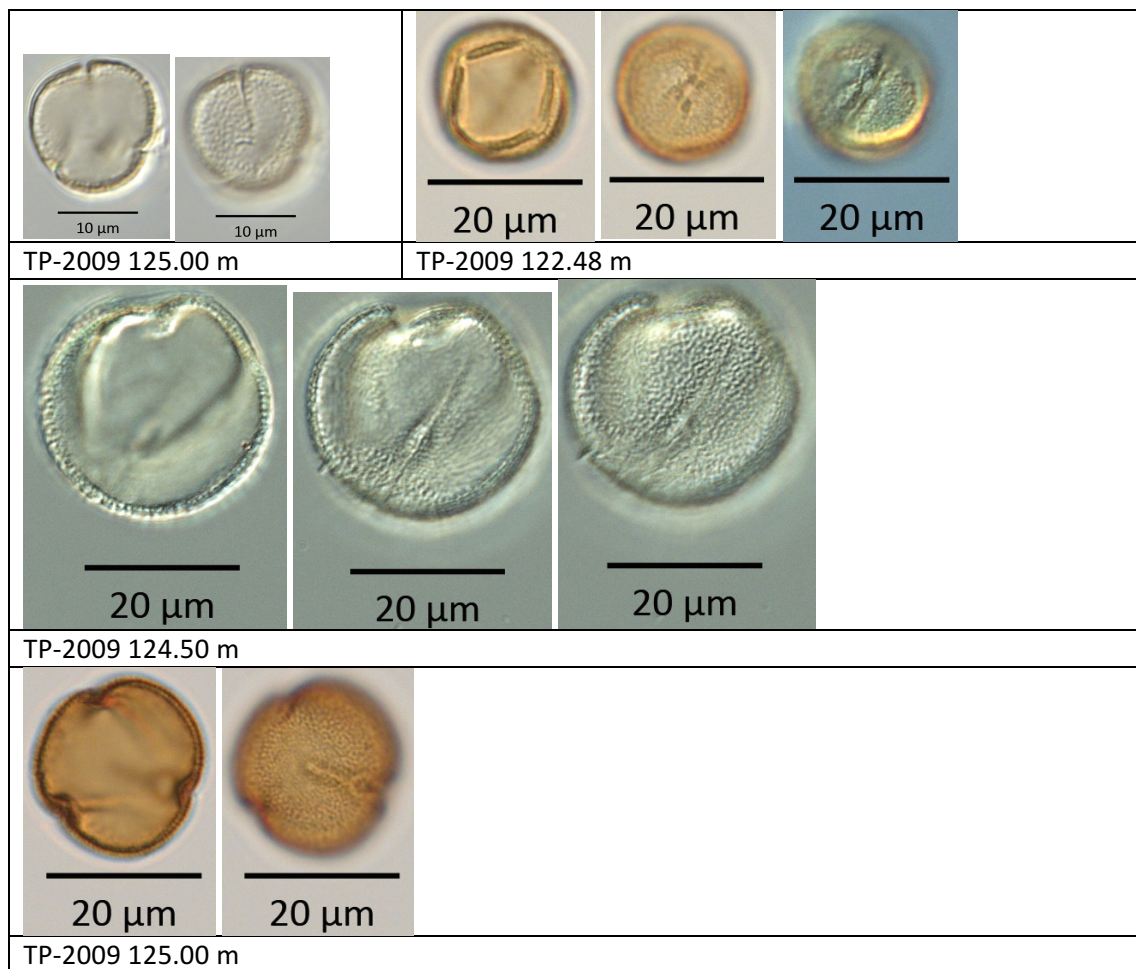
### General remarks

<b>Plant family</b>	Fabaceae
<b>Common names (English/German)</b>	Restharrows Hauhecheln
<b>Palynomorph group</b>	Non-arboreal pollen
<b>Growth form</b>	Herbaceous perennials (± annuals)

### Characteristics

<b>Pollen class</b>	Tricolporate
<b>Pollen grain shape</b>	Sphaeroid to prolate
<b>Pollen grain size</b>	19.8-35.8 µm
<b>Aperture</b>	Pori 4-8 µm, circular (± elongated) Colpi with costae
<b>Sculpture</b>	Suprareticulate, brochi 1.0-1.5(-1.8) µm, muri thin
<b>Sporoderm</b>	Exine 1.0-1.2 µm



***Rumex acetosa* type****General remarks**

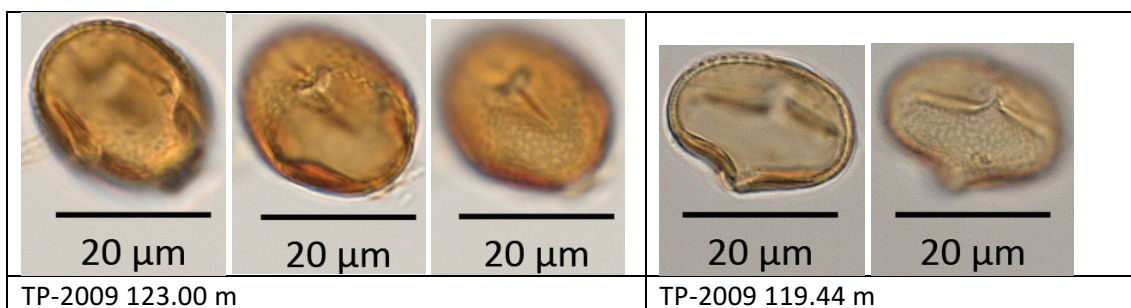
<b>Plant family</b>	Polygonaceae
<b>Common names (English/German)</b>	Common sorrel Wiesen-Sauerampfer
<b>Palynomorph group</b>	Non-arboreal pollen
<b>Growth form</b>	Herbaceous perennials

**Characteristics**

<b>Pollen class</b>	Tricolporate (± tetracolporate, than bigger)
<b>Pollen grain shape</b>	Sphaeroid-globose
<b>Pollen grain size</b>	16.8-35.9 µm, tetracolporate PG up to 40 µm
<b>Aperture</b>	Pori elongated (± circular), 2-4 x 1.5-2 µm Colpi thin
<b>Sculpture</b>	Microreticulate, brochi 1 µm, muri thick, lumina 0.5 µm small
<b>Sporoderm</b>	Exine 0.8-1.0(-1.3) µm



## *Trifolium* type



### General remarks

<b>Plant family</b>	Fabaceae
<b>Common names (English/German)</b>	Clover Klee
<b>Palynomorph group</b>	Non-arboreal pollen
<b>Growth form</b>	Herbaceous perennials (± annuals or biennials)

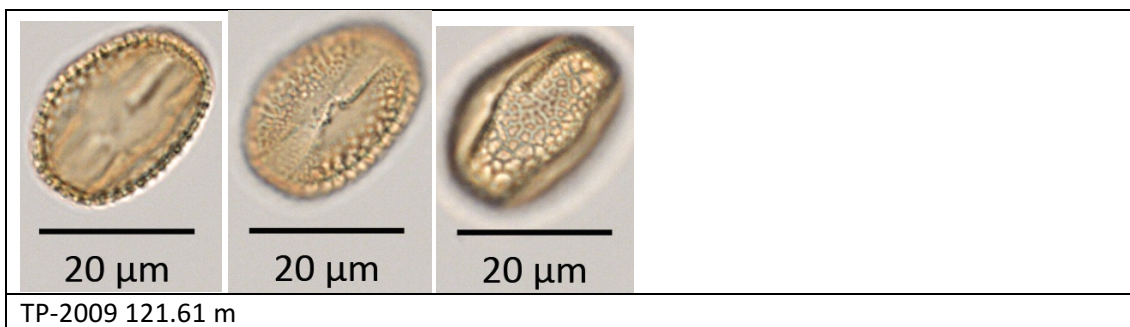
### Characteristics

<b>Pollen class</b>	Tricolporate, tricolporoidate
<b>Pollen grain shape</b>	Prolate, polar rounded or flattened
<b>Pollen grain size</b>	21.2-72.0 µm
<b>Aperture</b>	Pori circular or elongated, 8-14 µm or 7-11 x 6-8 µm (± butterfly-like)
<b>Sculpture</b>	Suprareticulate, brochi 1.0-9.0 µm (± heterobrochate), muri 1 µm; polar fields psilate
<b>Sporoderm</b>	Exine 1.2-2.5 µm

# Tricolporoidatae

per-, supra- or microreticulate, fossulate

*Sambucus ebulus*



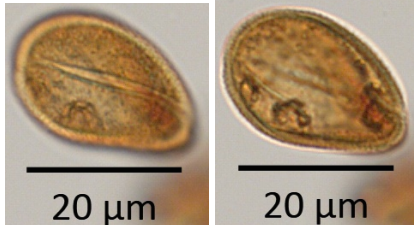
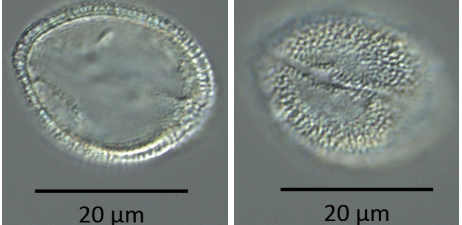
**General remarks**

<b>Plant family</b>	Adoxaceae
<b>Common names (English/German)</b>	Danewort Zwerg-Holunder
<b>Palynomorph group</b>	Arboreal pollen
<b>Growth form</b>	Herbaceous perennials

**Characteristics**

<b>Pollen class</b>	Tricolporoidate
<b>Pollen grain shape</b>	Sphaeroid
<b>Pollen grain size</b>	22.0-28.0 µm
<b>Aperture</b>	Colpi with broad, psilate margins Intercolpium margins incurved
<b>Sculpture</b>	Reticulate, heterobrochate: small brochi 1 µm, large brochi max. 3(-4) µm
<b>Sporoderm</b>	Exine eq. 2.0-3.5(-4.0) µm, polar thinner (min. 1.5 µm)

## Euphorbiaceae p.p.

			
TP-2009 123.72 m		<i>Mercurialis?</i> , TP-2009 124.50 m	

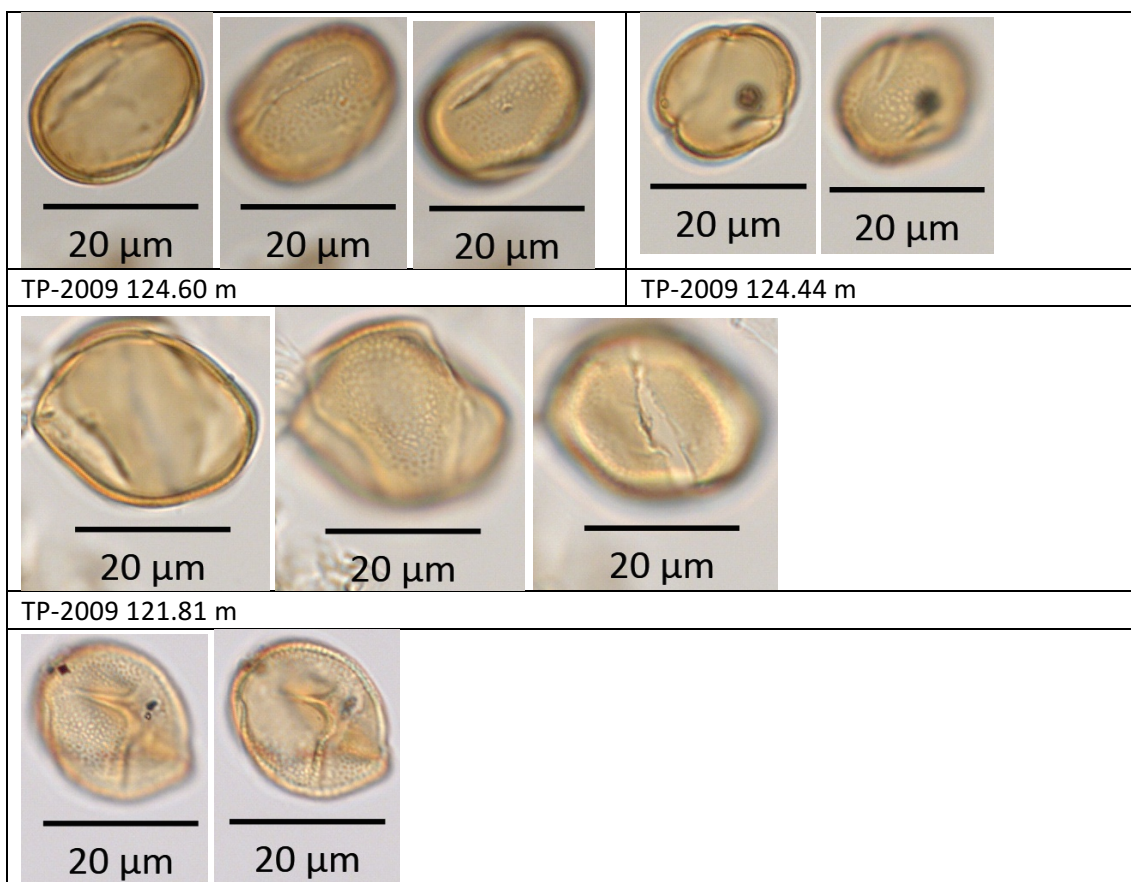
### General remarks

<b>Plant family</b>	Euphorbiaceae
<b>Common names (English/German)</b>	Spurge family Wolfsmilchgewächse
<b>Palynomorph group</b>	Non-arboreal pollen
<b>Growth form</b>	Herbaceous perennials, annuals or biennials, trees, shrubs, sub-shrubs

### Characteristics

<b>Pollen class</b>	Tricolporoidate, tricolporate
<b>Pollen grain shape</b>	Sphaeroid ( $\pm$ prolate or slightly apiculate in small PG)
<b>Pollen grain size</b>	17.7-51.0 $\mu\text{m}$
<b>Aperture</b>	Pori, if visible, rectangular and eq. elongated Colpi distinct recessed
<b>Sculpture</b>	Suprareticulate, brochi (0.8-)1.0-1.5(-2.0) $\mu\text{m}$ , muri broad, lumina small
<b>Sporoderm</b>	Exine (2.0-)2.5-3.0(-4.0) $\mu\text{m}$ Columellae long

## Genista group












### General remarks

Plant family	Fabaceae
Common names (English/German)	Broom Ginster
Palynomorph group	Non-arboreal pollen
Growth form	Deciduous tree or shrub

### Characteristics

Pollen class	Tricolporoidate, tricolpate
Pollen grain shape	Sphaeroid to prolate, globose, elliptic to rhomboid
Pollen grain size	20.0-44.6 µm
Aperture	Colpi variable
Sculpture	Suprareticulate, reticulate-rugulate to rugulate
Sporoderm	Exine 0.8-2.5 µm

***Primula clusiana* type**

 20 μm	 20 μm	 20 μm	 20 μm	 20 μm	 20 μm
TP-2009 127.91 m		TP-2009 121.81 m		TP-2009 123.04 m	
 20 μm	 20 μm	 20 μm			
TP-2009 124.44 m		TP-2009 126.80 m			

**General remarks**











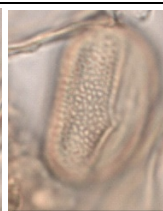



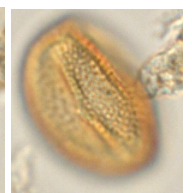










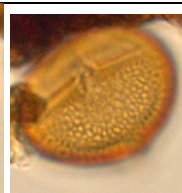
<b>Plant family</b>	Primulaceae
<b>Common names (English/German)</b>	Clusius-Primel
<b>Palynomorph group</b>	Non-arboreal pollen
<b>Growth form</b>	Herbaceous perennials

**Characteristics**

<b>Pollen class</b>	Tricolporoidate (± tetracolporoidate)
<b>Pollen grain shape</b>	Sphaeroid to prolate
<b>Pollen grain size</b>	11.2-35.2 µm; heterostylous: small (12.0-21.2 µm) and large PG (17.8-35.2 µm)
<b>Aperture</b>	Colpi eq. constricted
<b>Sculpture</b>	Small PG: psilate, large PG: microreticulate, brochi max. 1.2 µm
<b>Sporoderm</b>	Exine 0.8-2.0 µm



# Scrophulariaceae p.p.

 20 μm			 20 μm			 20 μm			 20 μm																														
<i>Lindernia procumbens</i> , TP-2009 122.04 m						<i>Lindernia procumbens</i> , TP-2009 127.10 m																																	
 20 μm				 20 μm				 20 μm				 20 μm				 20 μm																							
<i>L. procumbens</i> , TP-2009 123.00 m						TP-2009 125.90 m																																	
 20 μm				 20 μm				 20 μm				 20 μm				 20 μm				 20 μm																			
TP-2009 127.22 m						TP-2009 126.20 m																																	
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TP-2009 123.48 m								TP-2009 126.96 m																															
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TP-2009 124.50 m								TP-2009 121.49 m																															
 20 μm								 20 μm																															
TP-2009 120.52 m																																							

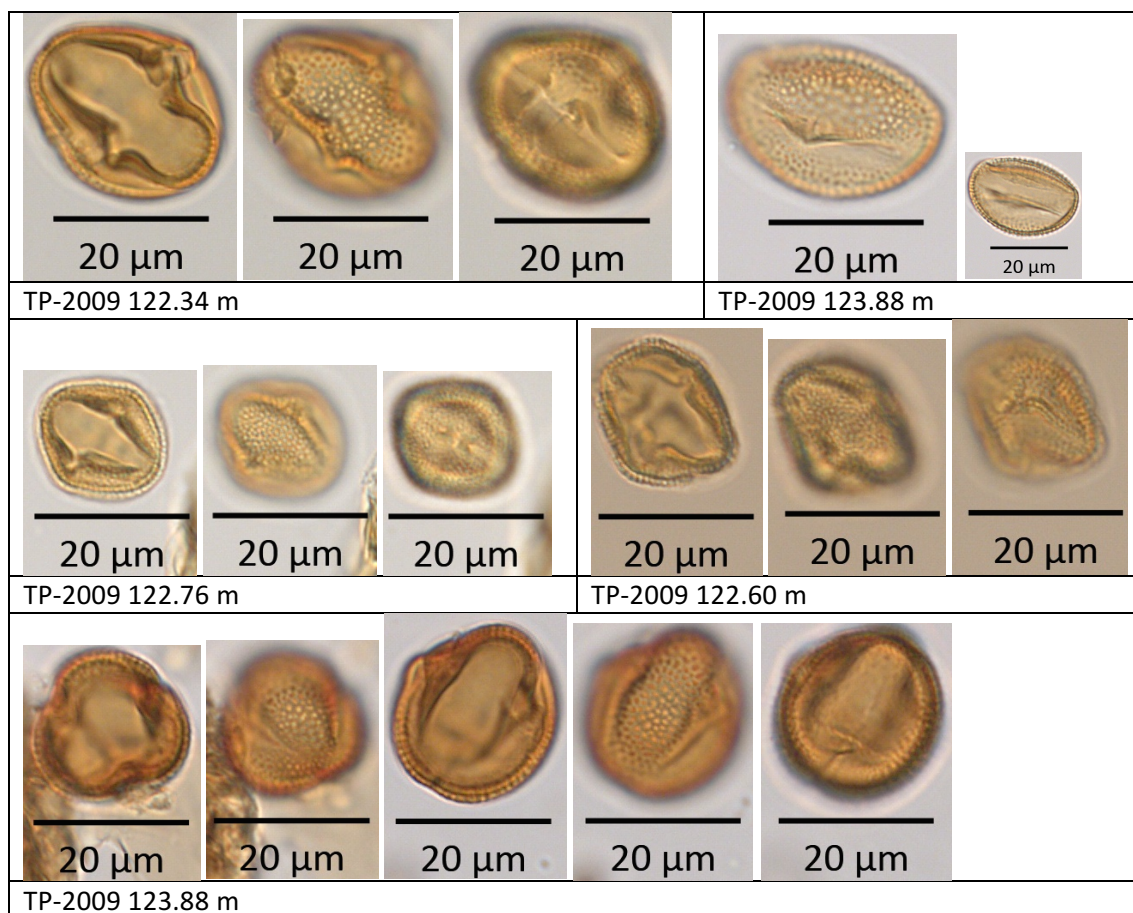
**General remarks**

<b>Plant family</b>	Scrophulariaceae
<b>Common names (English/German)</b>	Figwort family Braunwurzgewächse
<b>Palynomorph group</b>	Non-arboreal pollen
<b>Growth form</b>	Herbaceous perennials

**Characteristics**

<b>Pollen class</b>	Tricolporoidate
<b>Pollen grain shape</b>	Sphaeroid to prolate ( $\pm$ heteropolar-obconical), eq. rounded, elliptic, angular ( $\pm$ rhomboid)
<b>Pollen grain size</b>	14.0-37.2 $\mu\text{m}$
<b>Aperture</b>	Colpi eq. simple constricted
<b>Sculpture</b>	Microreticulate, reticulate, brochi 0.5-1.3(-2.0) $\mu\text{m}$
<b>Sporoderm</b>	Exine 0.8-1.8 $\mu\text{m}$

## Verbascum



### General remarks

<b>Plant family</b>	Scrophulariaceae
<b>Common names (English/German)</b>	Mullein Königskerzen
<b>Palynomorph group</b>	Non-arboreal pollen
<b>Growth form</b>	Herbaceous perennials or biennials (± annuals)

### Characteristics

<b>Pollen class</b>	Tricolporoidate
<b>Pollen grain shape</b>	Sphaeroid-prolate
<b>Pollen grain size</b>	15.1-33.3 µm
<b>Aperture</b>	Colpi s-shaped constricted
<b>Sculpture</b>	Microreticulate (±reticulate), brochi 1-1.3(-2.0) µm
<b>Sporoderm</b>	Exine 1.3-1.8 µm, polar ± max. 2.0 µm

# Syncolpatae

## *Loranthus europaeus*



TP-2009 126.20 m

### General remarks

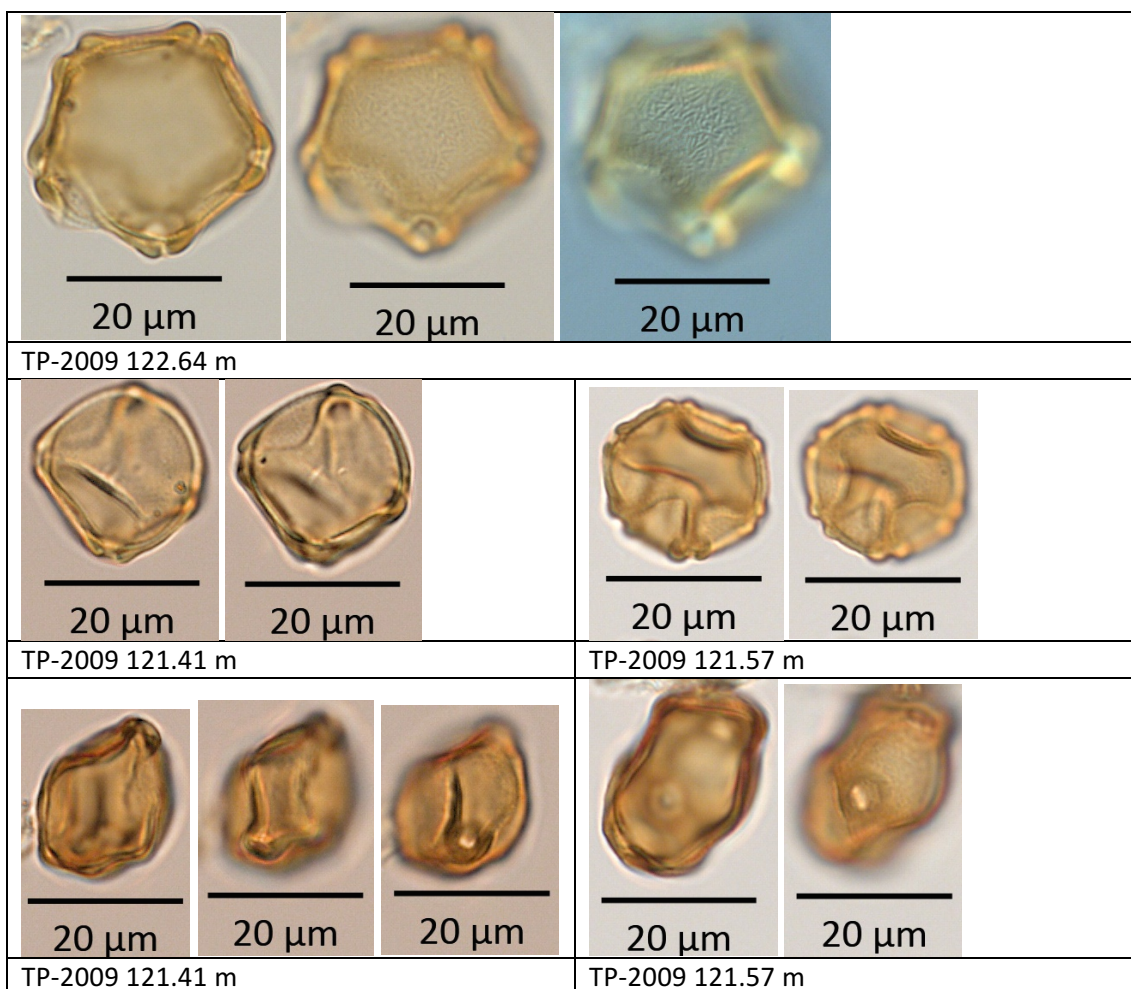
<b>Plant family</b>	Loranthaceae
<b>Common names (English/German)</b>	Summer mistletoe Eichenmistel
<b>Palynomorph group</b>	Arboreal pollen
<b>Growth form</b>	Epiphyte

### Characteristics

<b>Pollen class</b>	Tricolpate-syncolpate
<b>Pollen grain shape</b>	Oblate, polar triangular, heteropolar: convex and flat or slightly concave hemispheres
<b>Pollen grain size</b>	25.3-33.8
<b>Aperture</b>	Intercolpi concave
<b>Sculpture</b>	Scabrate, irregular, max. 1 μm
<b>Sporoderm</b>	Exine max. 2 μm

# Stephanoporatae



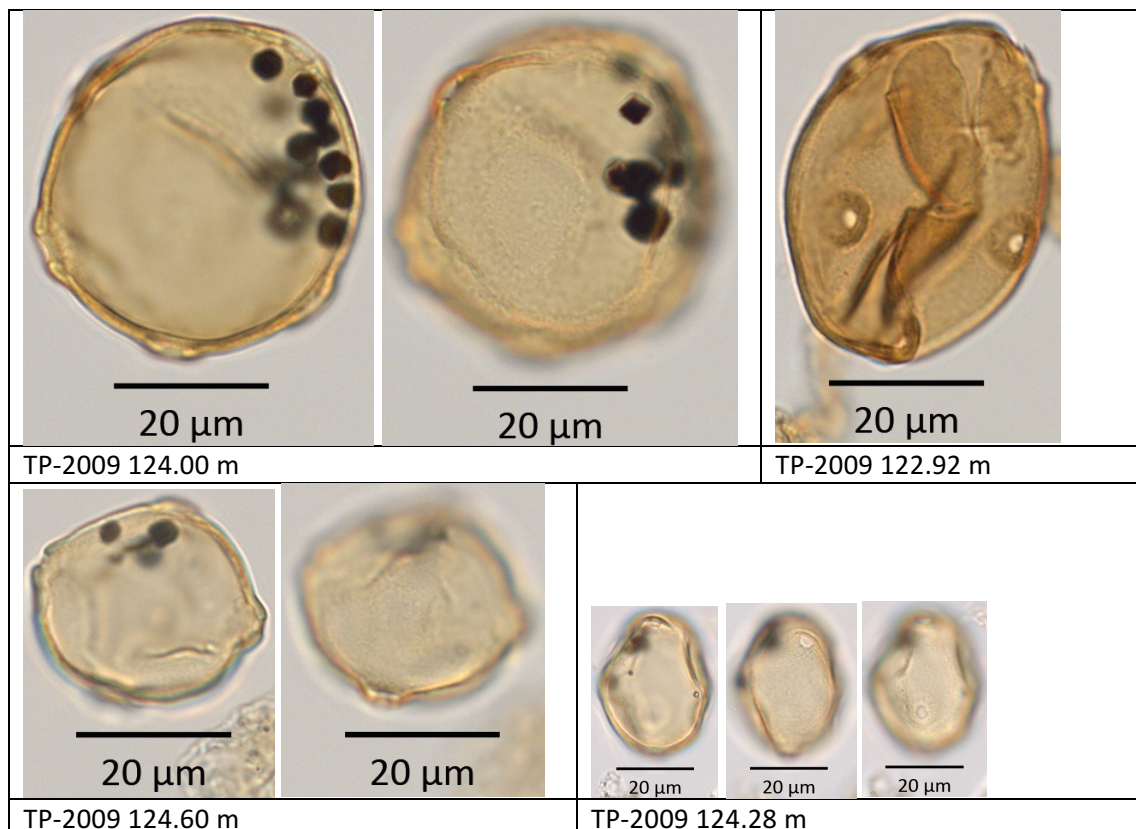
*Alnus***General remarks**

<b>Plant family</b>	Betulaceae
<b>Common names (English/German)</b>	Black alder Schwarz-Erle
<b>Palynomorph group</b>	Arboreal pollen
<b>Growth form</b>	Deciduous tree

**Characteristics**

<b>Pollen class</b>	Stephanoporate, (3-)4-5(-6) pori
<b>Pollen grain shape</b>	Sphaeroid to oblate, flattened, dependig on pore number 3- to 6-angular
<b>Pollen grain size</b>	22.5-33.5 µm
<b>Aperture</b>	Pori elongated, 1.5-2.5 x 3-4 µm; with annulus; with or without arci; vestibula 7.0-8.5 µm diameter, 3.0-3.5 µm high
<b>Sculpture</b>	Scabrate
<b>Sporoderm</b>	Exine 1.2-1.5 µm Columellae not visible
<b>Ecology</b>	Tolerant to cold, but not to drought

## *Carpinus betulus*



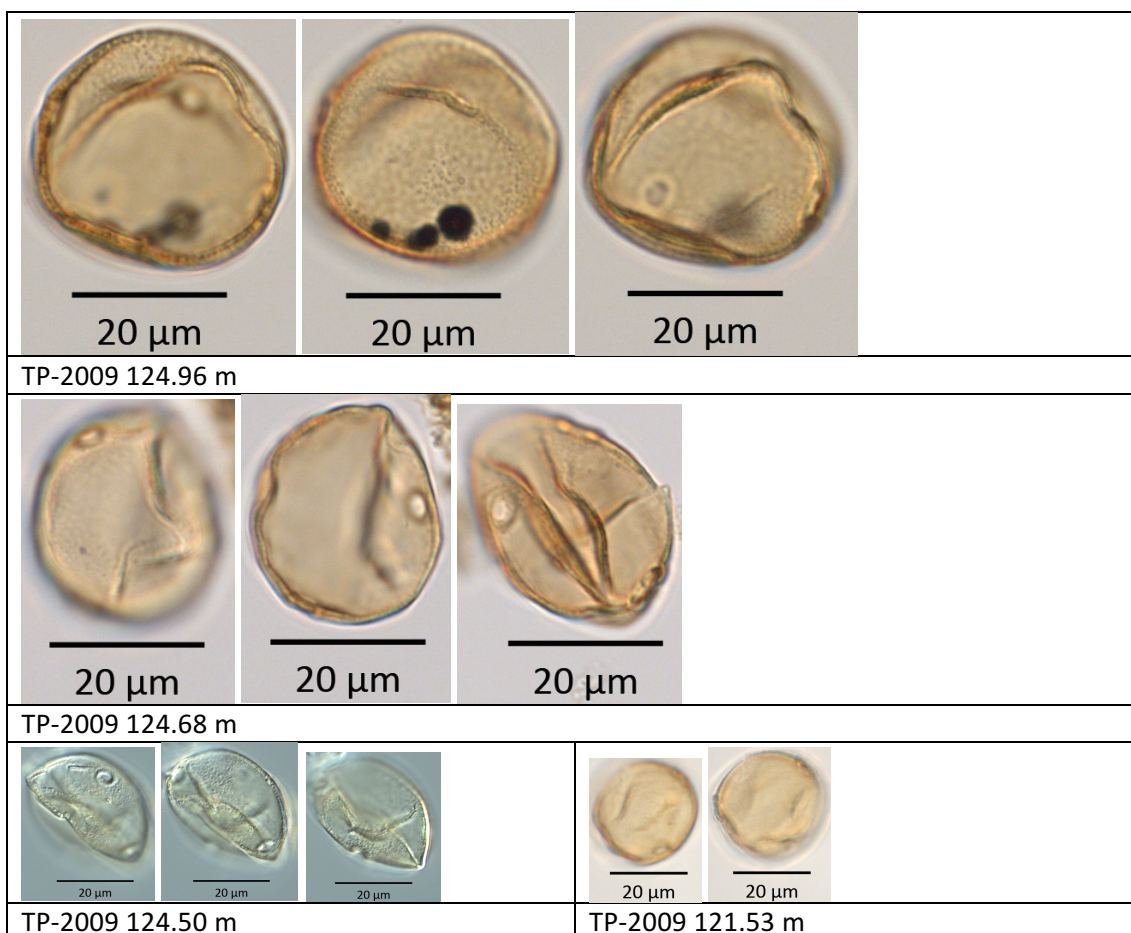
### General remarks

<b>Plant family</b>	Betulaceae
<b>Common names (English/German)</b>	European hornbeam Gemeine Hainbuche
<b>Palynomorph group</b>	Arboreal pollen
<b>Growth form</b>	Deciduous tree

### Characteristics

<b>Pollen class</b>	Stephanoporate, (2-)3-5(-7) pori
<b>Pollen grain shape</b>	Sphaeroid flattened ( $\pm$ oblate)
<b>Pollen grain size</b>	37.5-48.0 $\mu$ m
<b>Aperture</b>	Pori 2.8-3.2 $\mu$ m, ( $\pm$ elongated, 2.7-3.5 x 3.0-4.8 $\mu$ m), with vestibulum
<b>Sculpture</b>	Psilate
<b>Sporoderm</b>	Exine 1.3-1.6 $\mu$ m
<b>Ecology</b>	Requires warm conditions and higher moisture availability (Christanis 1983)

## *Celtis*

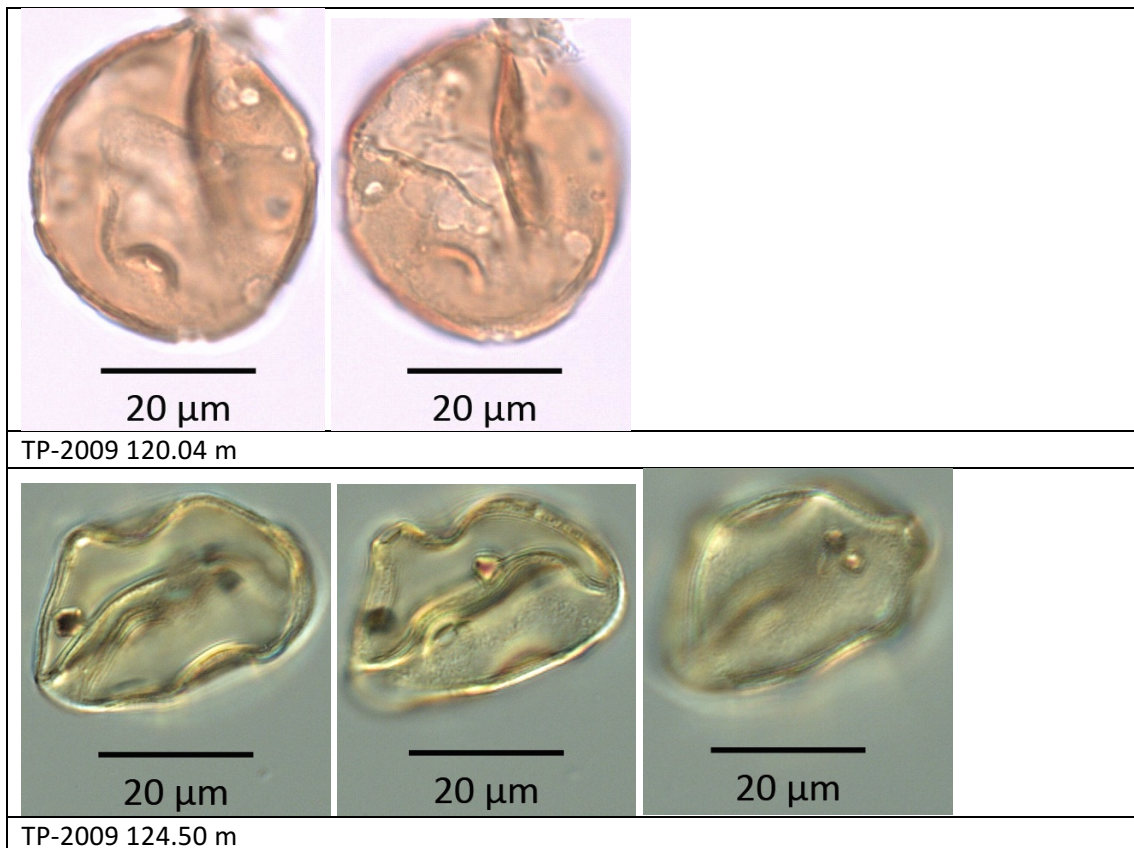


### General remarks

<b>Plant family</b>	Cannabaceae
<b>Common names (English/German)</b>	Hackberries Zürgelbäume, Nesselbäume
<b>Palynomorph group</b>	Arboreal pollen
<b>Growth form</b>	Deciduous trees (± shrubs)

### Characteristics

<b>Pollen class</b>	Stephanoporate, 3-5 pori (mostly tetraporate)
<b>Pollen grain shape</b>	Sphaeroid flattened (± oblate)
<b>Pollen grain size</b>	28.8-40.0 µm
<b>Aperture</b>	Pori 3.5-4.5 µm, with annulus
<b>Sculpture</b>	Psilate
<b>Sporoderm</b>	Exine 1.7-1.9 µm Columellae thin
<b>Remarks</b>	Tectum thick and columellae visible in contrast to <i>Humulus</i> type and <i>Cannabis</i>

*Juglans***General remarks**


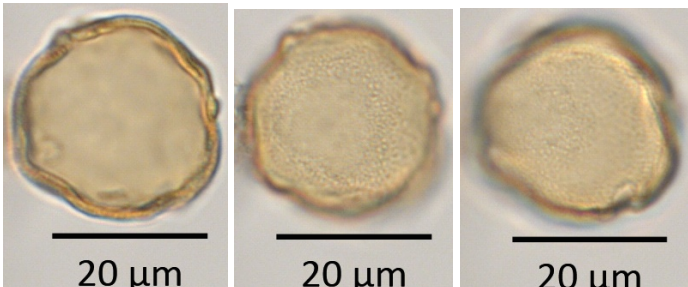

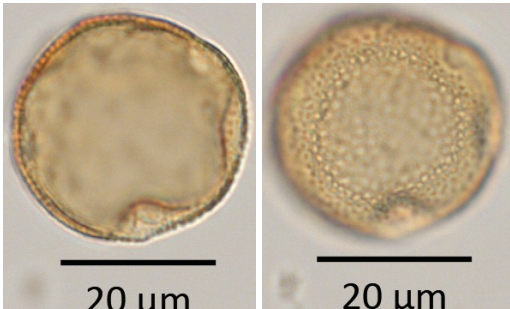
<b>Plant family</b>	Juglandaceae
<b>Common names (English/German)</b>	Walnut tree Walnüsse
<b>Palynomorph group</b>	Arboreal pollen
<b>Growth form</b>	Deciduous tree or shrub

**Characteristics**

<b>Pollen class</b>	Stephanoporate, heteropolar: eq. 7-11 pori, 1-6 on one polar field
<b>Pollen grain shape</b>	Slightly sphaeroid to oblate, polar angular
<b>Pollen grain size</b>	33.3-53.3 µm
<b>Aperture</b>	Pori 2.0-4.5 µm
<b>Sculpture</b>	Scabrate, consistent dotted pattern, 0.4-0.6 µm
<b>Sporoderm</b>	Exine 1.8-2.0 µm Columellae not visible



*Pistacia*

 <p>20 µm</p>	 <p>20 µm      20 µm      20 µm</p>
TP-2009 124.50 m	TP-2009 124.60 m
 <p>20 µm</p>	 <p>20 µm      20 µm</p>
TP-2009 124.50 m	TP-2009 124.72 m

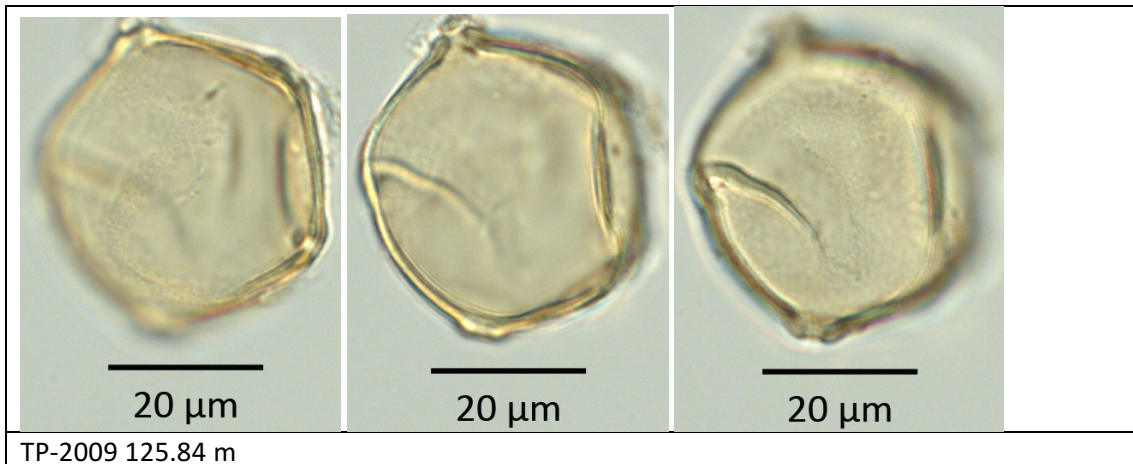
**General remarks**

<b>Plant family</b>	Anacardiaceae
<b>Common names (English/German)</b>	Pistachio Pistazien
<b>Palynomorph group</b>	Arboreal pollen
<b>Growth form</b>	Deciduous or indeciduous tree or shrub

**Characteristics**

<b>Pollen class</b>	Stephanoporate, 4-5 pori (± periporate, 6-8 pori)
<b>Pollen grain shape</b>	Sphaeroid
<b>Pollen grain size</b>	28.0-37.0 µm
<b>Aperture</b>	Pori oval to slit-shaped
<b>Sculpture</b>	
<b>Sporoderm</b>	Exine 1.5 µm
<b>Ecology</b>	Requires warm, but drier conditions and frostfree winters; low pollen producer; greatest abundance in the Mediterranean in Holocene (Christanis 1983, Müller et al. 2011, Rossignol-Strick 1999)

## *Pterocarya*



### General remarks

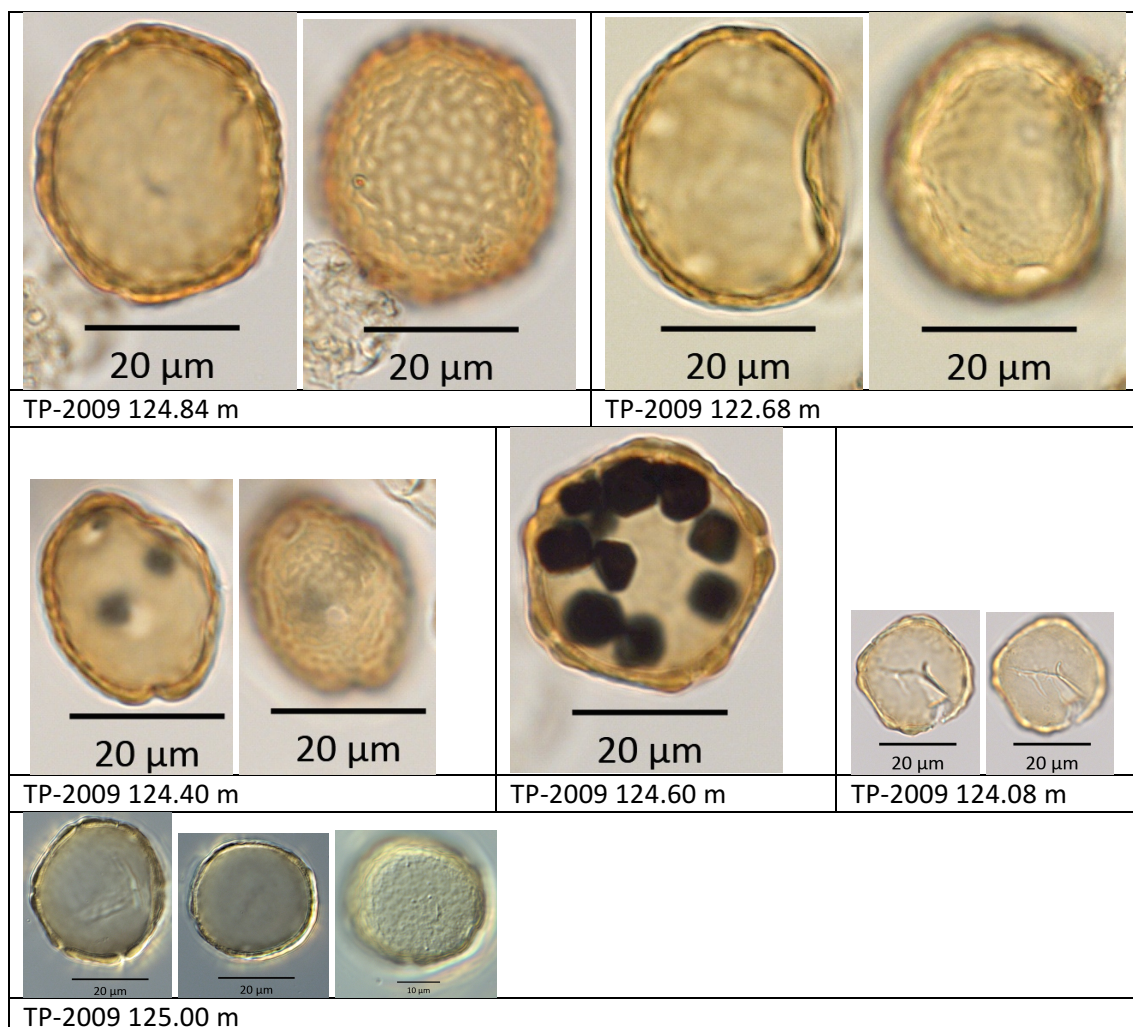
<b>Plant family</b>	Juglandaceae
<b>Common names (English/German)</b>	Wingnuts Flügelnüsse
<b>Palynomorph group</b>	Arboreal pollen
<b>Growth form</b>	Deciduous tree

### Characteristics

<b>Pollen class</b>	Stephanoporate, 5-6(-7) pori
<b>Pollen grain shape</b>	Flattened, polar angular
<b>Pollen grain size</b>	34.0-41.8 µm
<b>Aperture</b>	Pori 3.2 µm; vestibula 8-10 µm diameter, 2.8-4.0 µm high
<b>Sculpture</b>	Scabrate, microverrucate, consistent dotted, 0.5 µm
<b>Sporoderm</b>	Exine 1.5-1.8 µm Columellae not visible



## *Ulmus*

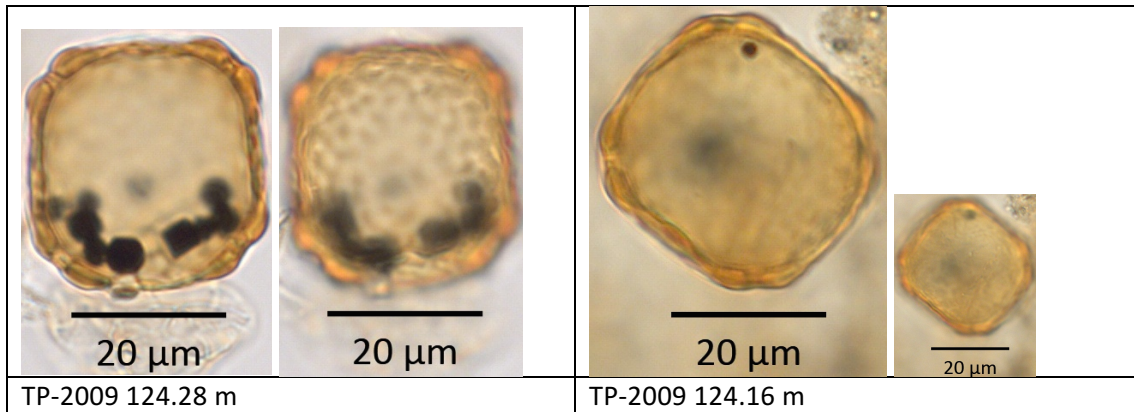


### General remarks

<b>Plant family</b>	Ulmaceae
<b>Common names (English/German)</b>	Elm Ulmen
<b>Palynomorph group</b>	Arboreal pollen
<b>Growth form</b>	Deciduous or semi-deciduous tree (± shrub)

### Characteristics

<b>Pollen class</b>	Stephanoporate, 4-6(-7) pori, mostly 5 pori
<b>Pollen grain shape</b>	Sphaeroid to slightly oblate, eq. 4-6-angular
<b>Pollen grain size</b>	30.0-40.3 µm
<b>Aperture</b>	Pori with annulus
<b>Sculpture</b>	(Supra-)reticulate, rugulate, brochi 2-5 µm large, muri 0.8-1.5 µm broad, heteropolar
<b>Sporoderm</b>	Exine 1.5-2.0 µm, near annuli (2.0-)2.2-3.0 µm
<b>Ecology</b>	Requires warm conditions and higher moisture availability (Christanis 1983)


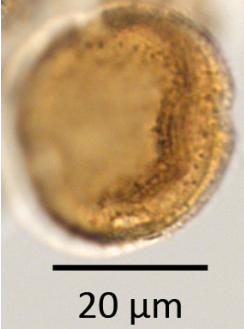



**Zelkova****General remarks**

<b>Plant family</b>	Ulmaceae
<b>Common names (English/German)</b>	Zelkova Zelkoven
<b>Palynomorph group</b>	Arboreal pollen
<b>Growth form</b>	Deciduous tree (± shrub)

**Characteristics**

<b>Pollen class</b>	Stephanoporate, 4-5(-7) pori, mostly 5 pori
<b>Pollen grain shape</b>	Sphaeroid to slightly oblate, eq. 4-6-angular
<b>Pollen grain size</b>	35.3-49.3 µm
<b>Aperture</b>	Pori with annulus
<b>Sculpture</b>	(Supra-)reticulate, rugulate, brochi 2-5 µm large, muri 0.8-1.5 µm broad, heteropolar
<b>Sporoderm</b>	Exine 1.5-2.0 µm, near annuli (2.0-)2.2-3.0 µm

## Campanulaceae p.p.

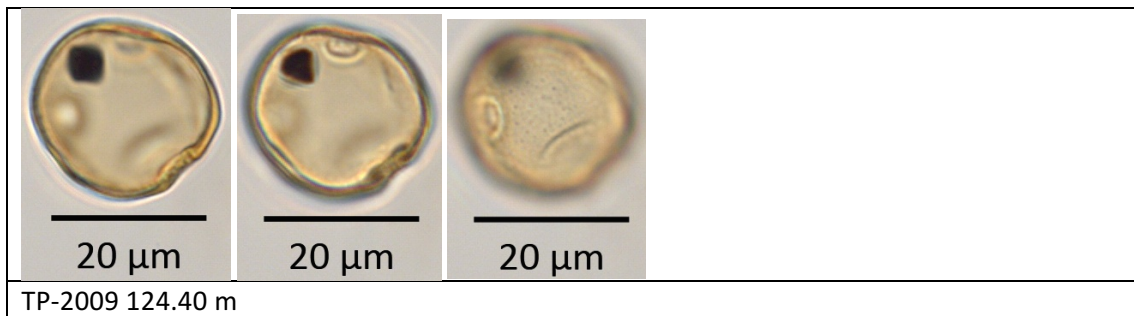
		
TP-2009 123.32 m		TP-2009 123.60 m
		
TP-2009 126.28 m		

### General remarks

<b>Plant family</b>	Campanulaceae
<b>Common names (English/German)</b>	Bellflower family Glockenblumengewächse
<b>Palynomorph group</b>	Non-arboreal pollen
<b>Growth form</b>	Herbaceous annuals (mostly)

### Characteristics

<b>Pollen class</b>	Stephanoporate, 2-6 pori
<b>Pollen grain shape</b>	Sphaeroid, polar circular, rounded-angular or elliptic
<b>Pollen grain size</b>	23.0-51.8 µm
<b>Aperture</b>	Pori 3-6 µm, costae 1-2(-3) µm broad, 1.5-2.5 µm thick
<b>Sculpture</b>	Echinate, microechinate, scabrate, 0.5-2.0(-4.0) µm, echini distance scabrate 1-2 µm, others 3-6 µm
<b>Sporoderm</b>	Exine 1.5 µm

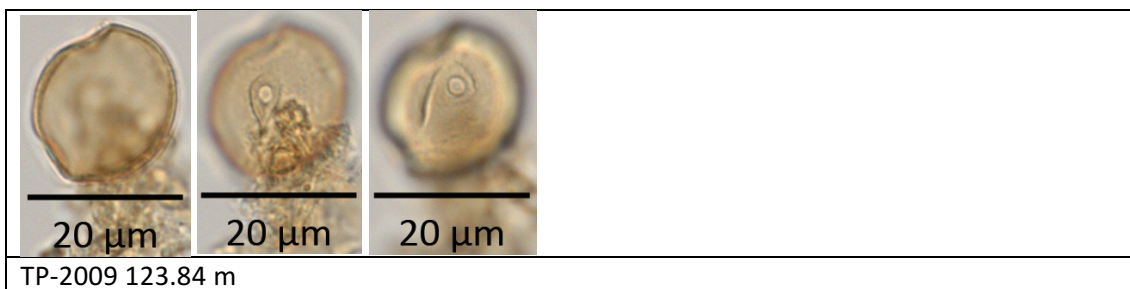
***Jasione montana* type****General remarks**

<b>Plant family</b>	Campanulaceae
<b>Common names (English/German)</b>	Sheep's bit scabious Berg-Sandglöckchen
<b>Palynomorph group</b>	Non-arboreal pollen
<b>Growth form</b>	Herbaceous annuals or biennials

**Characteristics**

<b>Pollen class</b>	Stephanoporate, 3 pori
<b>Pollen grain shape</b>	Sphaeroid, polar circular
<b>Pollen grain size</b>	23.0-30.0 µm
<b>Aperture</b>	
<b>Sculpture</b>	Microechinate, scabrate, 0.5 µm, echini distance 1-2 µm
<b>Sporoderm</b>	

### *Legousia* type



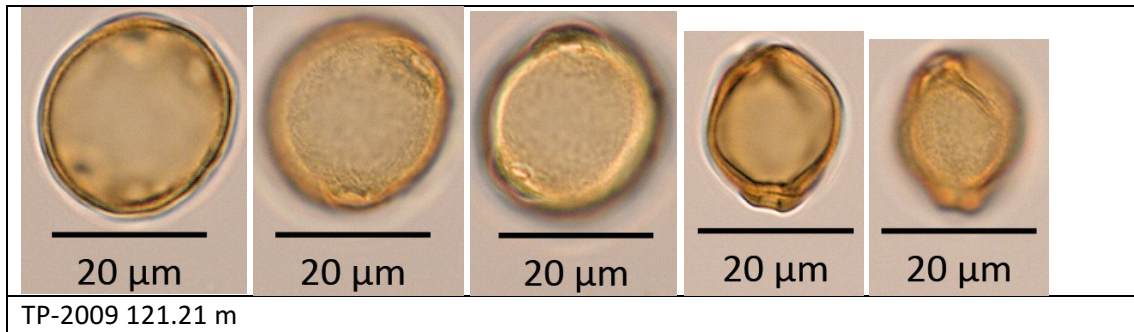
#### General remarks

<b>Plant family</b>	Campanulaceae
<b>Common names (English/German)</b>	Venus' looking glass Frauenspiegel
<b>Palynomorph group</b>	Non-arboreal pollen
<b>Growth form</b>	Herbaceous annuals

#### Characteristics

<b>Pollen class</b>	Stephanoporate, 4-6 pori
<b>Pollen grain shape</b>	Sphaeroid, polar elliptic
<b>Pollen grain size</b>	24.5-33.0 µm
<b>Aperture</b>	
<b>Sculpture</b>	Microechinate, scabrate, 0.5 µm, echini distance 1-2 µm
<b>Sporoderm</b>	

### *Myriophyllum alterniflorum*



#### General remarks

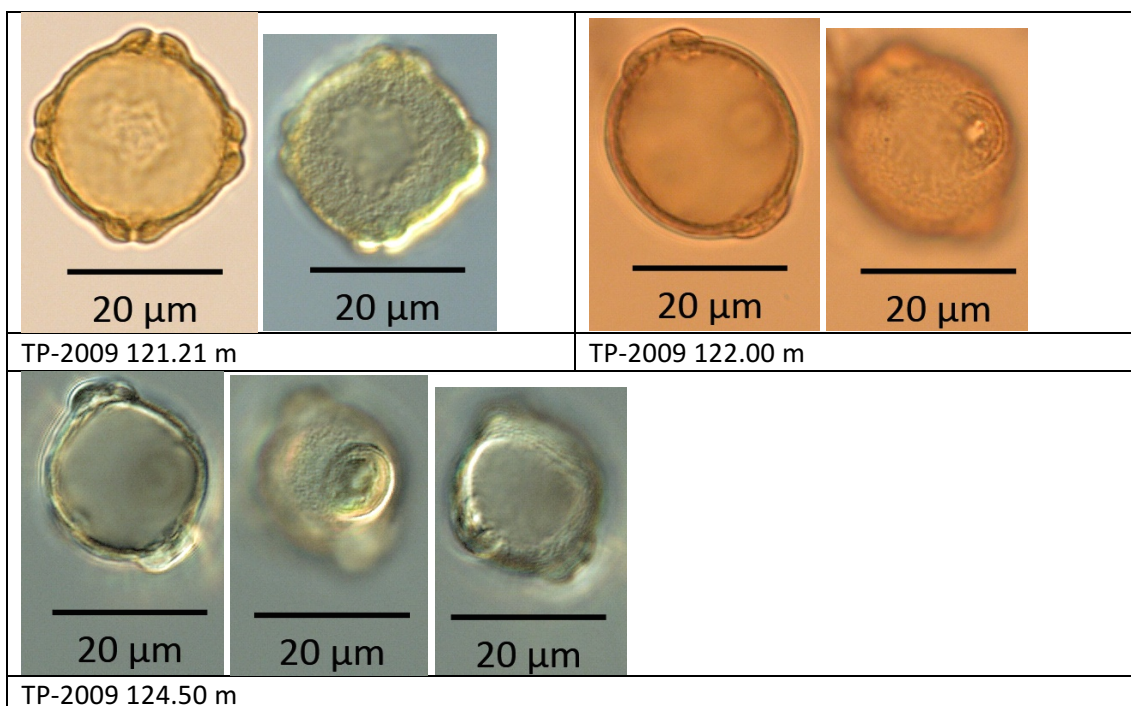
<b>Plant family</b>	Haloragaceae
<b>Common names (English/German)</b>	Wechselblütiges Tausendblatt
<b>Palynomorph group</b>	<a href="#">Aquatic</a>
<b>Growth form</b>	Hydrophyte, indeciduous herbaceous perennials

#### Characteristics

<b>Pollen class</b>	Stephanoporate
<b>Pollen grain shape</b>	Sphaeroid-globose
<b>Pollen grain size</b>	29.8-36.0 µm
<b>Aperture</b>	Pori circular to oval, 2.2-5.8 x 3.8-5.8 µm; two opposing groups of (1-)2-3(-4) pori (± 1 pore outside the group); with broad, thick annulus
<b>Sculpture</b>	Scabrate
<b>Sporoderm</b>	Exine 1.3-1.5 µm
<b>Ecology</b>	Requires high content of minerals and nutrients as well as alkaline conditions and can be indicative of brackish conditions (de Lange & van Zorn 1973, Pals et al. 1980), prefers fresh-mesohaline conditions and water depths of ca. 1-4.8 m (Harrison & Digerfeldt 1990, Hannon & Gaillard 1997, Brush & Hilgartner 2000, Herzschuh et al. 2005)



## *Myriophyllum spicatum*



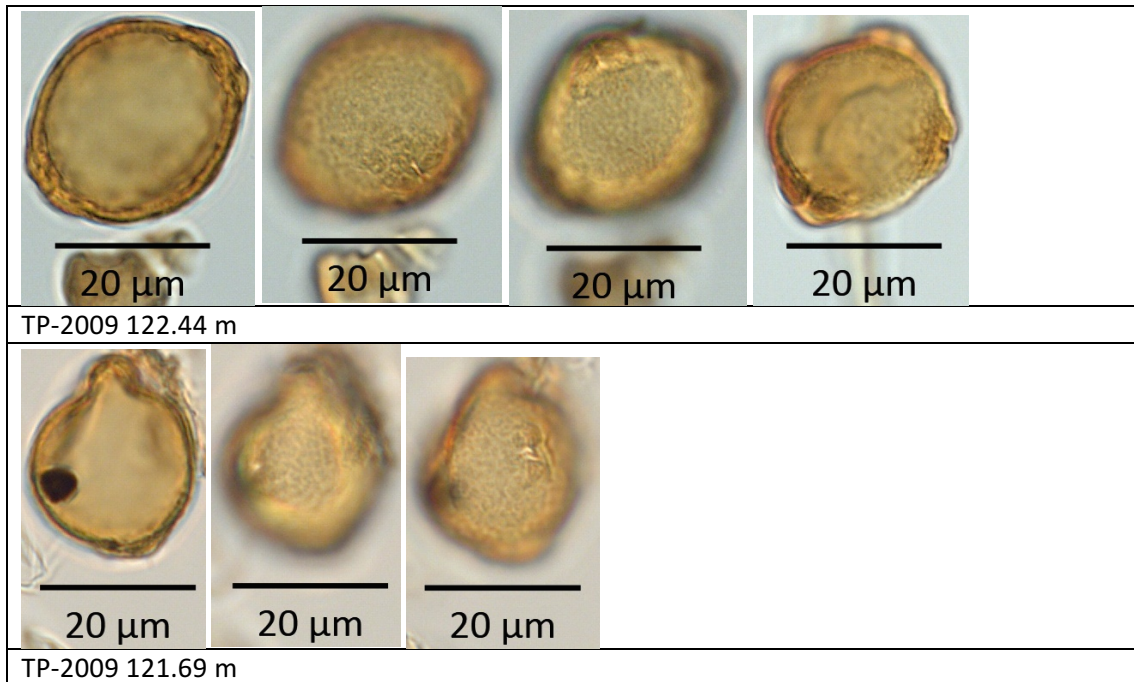
### General remarks

<b>Plant family</b>	Haloragaceae
<b>Common names (English/German)</b>	Eurasian watermilfoil Ähriges Tausendblatt
<b>Palynomorph group</b>	<a href="#">Aquatic</a>
<b>Growth form</b>	Hydrophyte, herbaceous perennials

### Characteristics

<b>Pollen class</b>	Stephanoporate, (3-)4-5 pori
<b>Pollen grain shape</b>	Sphaeroid flattened
<b>Pollen grain size</b>	23.0-31.5 µm
<b>Aperture</b>	Pori oval, 1.8-2.2 x 3.5-4.0 µm, with broad, thick annulus
<b>Sculpture</b>	Psilate
<b>Sporoderm</b>	Exine 1.0-1.2 µm
<b>Ecology</b>	Requires high content of minerals and nutrients as well as alkaline conditions and can be indicative of brackish conditions (de Lange & van Zorn 1973, Pals et al. 1980), prefers fresh-mesohaline conditions and water depths of ca. 1-4.8 m (Harrison & Digerfeldt 1990, Hannon & Gaillard 1997, Brush & Hilgartner 2000, Herzsuh et al. 2005)

## *Myriophyllum verticillatum*



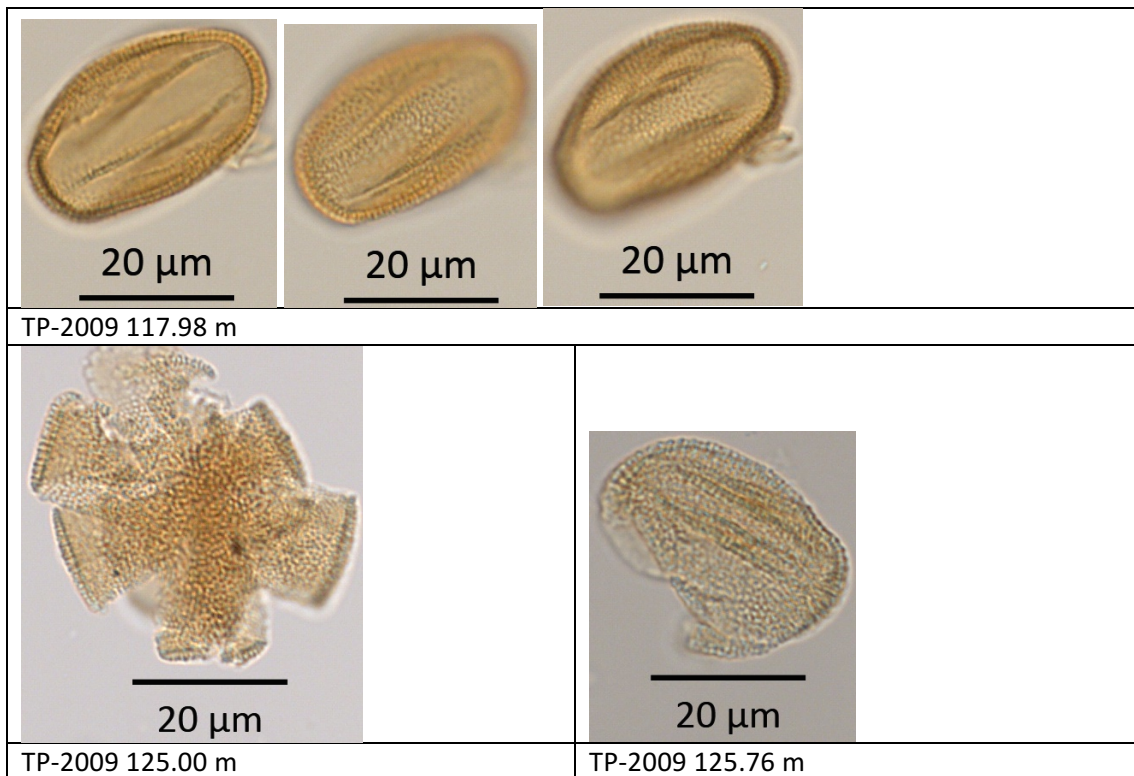
### General remarks

<b>Plant family</b>	Haloragaceae
<b>Common names (English/German)</b>	Whorled watermilfoil Quirliges Tausendblatt
<b>Palynomorph group</b>	<a href="#">Aquatic</a>
<b>Growth form</b>	Hydrophyte, herbaceous perennials

### Characteristics

<b>Pollen class</b>	Stephanoporate, (3-)4(-5) pori
<b>Pollen grain shape</b>	Sphaeroid flattened to oblate
<b>Pollen grain size</b>	24.5-34.5 µm
<b>Aperture</b>	Pori slit-shaped, 3.5-5.0 x 1.0-2.0 µm, with broad, thick annulus
<b>Sculpture</b>	Psilate
<b>Sporoderm</b>	Exine 1.2-1.8 µm
<b>Ecology</b>	Requires high content of minerals and nutrients as well as alkaline conditions and can be indicative of brackish conditions (de Lange & van Zorn 1973, Pals et al. 1980), prefers fresh-mesohaline conditions and water depths of ca. 1-4.8 m (Harrison & Digerfeldt 1990, Hannon & Gaillard 1997, Brush & Hilgartner 2000, Herzsuh et al. 2005)

# Stephanocolpatae





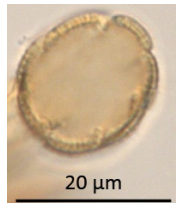
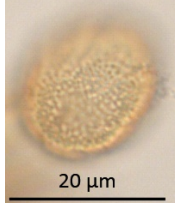
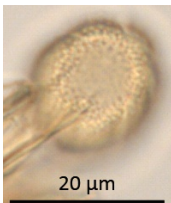
***Mentha* type****General remarks**

<b>Plant family</b>	Lamiaceae
<b>Common names (English/German)</b>	Mint Minzen
<b>Palynomorph group</b>	Non-arboreal pollen
<b>Growth form</b>	Herbaceous perennials

**Characteristics**

<b>Pollen class</b>	Stephanocolpate, 6(-8) colpi
<b>Pollen grain shape</b>	Sphaeroid to prolate
<b>Pollen grain size</b>	21.8-57.5 µm
<b>Aperture</b>	Intercolpi equal broad or 3 thin and 3 broad
<b>Sculpture</b>	Reticulate, macrobrochi 0.3-1.5 µm, max. 3 microbrochi in macrobrochi
<b>Sporoderm</b>	Exine 1-2 µm Columellae distinct
<b>Remarks</b>	<i>Prunella</i> type with more than 4 microbrochi

### *Primula veris* group

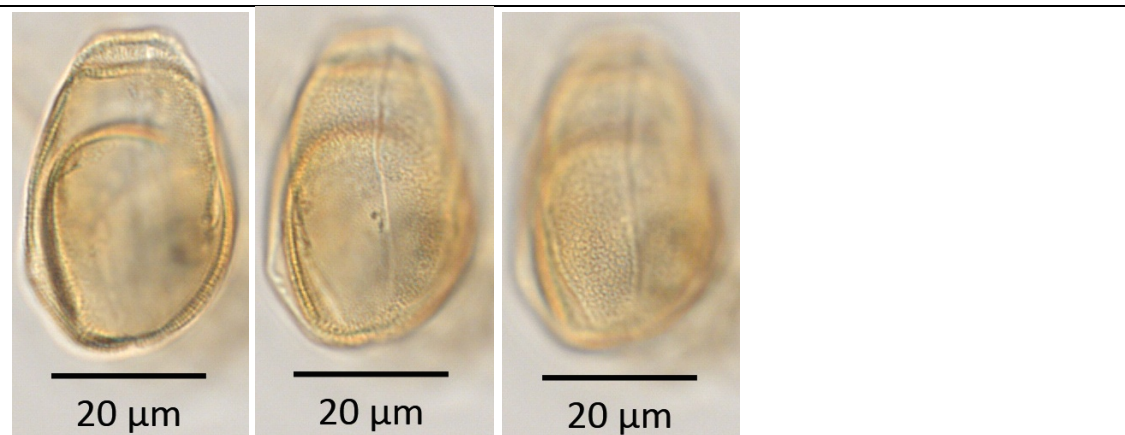
							
TP-2009 124.50 m				TP-2009 123.88 m			
							
TP-2009 126.28 m							

#### General remarks

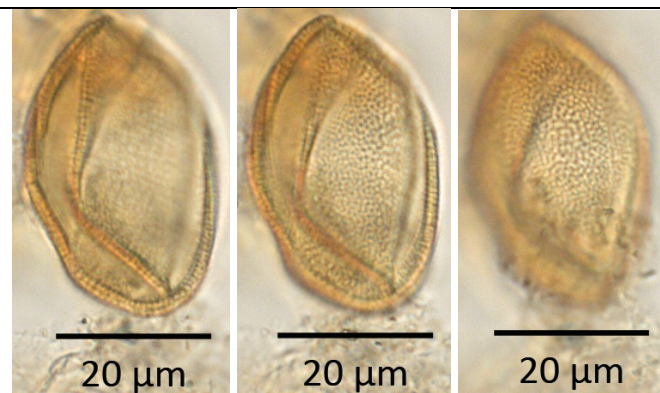
<b>Plant family</b>	Primulaceae
<b>Common names (English/German)</b>	Cowslip Echte Schlüsselblume
<b>Palynomorph group</b>	Non-arboreal pollen
<b>Growth form</b>	Herbaceous perennials

#### Characteristics

<b>Pollen class</b>	Stephanocolpate, 5-9 colpi
<b>Pollen grain shape</b>	Sphaeroid to prolate
<b>Pollen grain size</b>	10.0-28.0 µm
<b>Aperture</b>	
<b>Sculpture</b>	Reticulate, microreticulate
<b>Sporoderm</b>	Exine intectate, reticulate Heterostylous: larger PG brevistyl, exine max. 1.8 µm, brochi 1.0-1.5 µm; smaller PG longistyl, exine max. 1 µm, brochi max. 1 µm

***Prunella* type**

TP-2009 124.60 m



TP-2009 124.16 m

**General remarks**

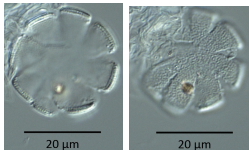
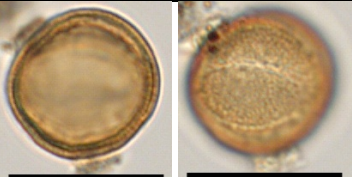
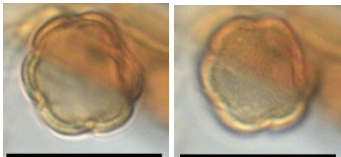
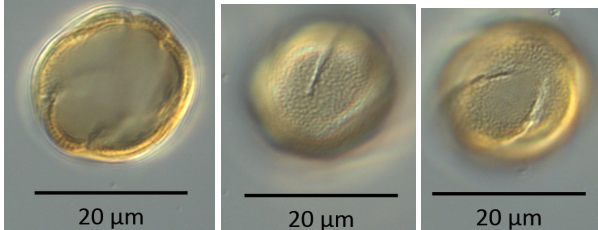
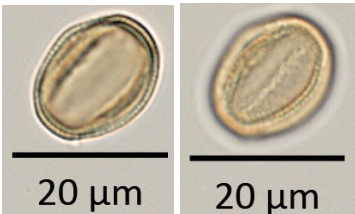
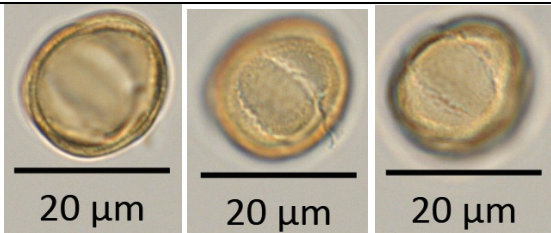
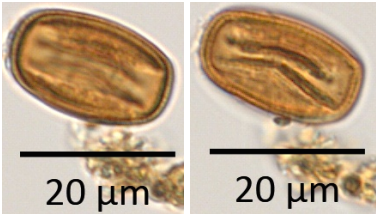
<b>Plant family</b>	Lamiaceae
<b>Common names (English/German)</b>	Self-heal Braunelle
<b>Palynomorph group</b>	Non-arboreal pollen
<b>Growth form</b>	Herbaceous perennials

**Characteristics**

<b>Pollen class</b>	Stephanocolpate, 6(-8) colpi
<b>Pollen grain shape</b>	Sphaeroid to prolate
<b>Pollen grain size</b>	26.6-64.3 µm
<b>Aperture</b>	Intercolpi equal broad or 3 thin and 3 broad
<b>Sculpture</b>	Reticulate, macrobrochi 2-5(-7) µm, >4 microbrochi in macrobrochi, 0.5 µm
<b>Sporoderm</b>	
<b>Remarks</b>	<i>Mentha</i> type with less than 3 microbrochi



## Rubiaceae

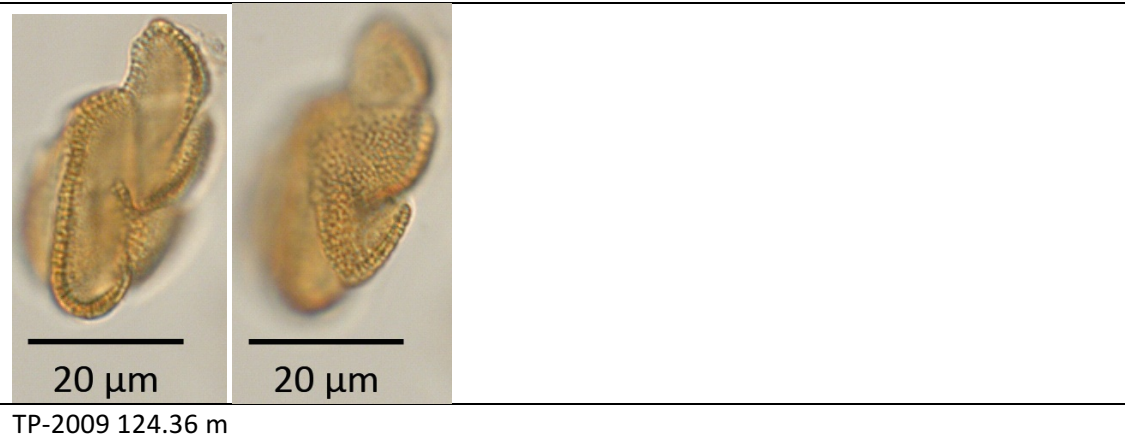
	 20 µm      20 µm	 20 µm      20 µm
TP-2009 124.50 m	TP-2009 123.52 m	TP-2009 127.38 m
 20 µm      20 µm      20 µm	 20 µm      20 µm	
TP-2009 121.00 m	TP-2009 122.00 m	
 20 µm      20 µm      20 µm	 20 µm      20 µm	
TP-2009 121.49 m	TP-2009 123.04 m	

### General remarks

<b>Plant family</b>	Rubiaceae
<b>Common names (English/German)</b>	Bedstraw Labkräuter
<b>Palynomorph group</b>	Non-arboreal pollen
<b>Growth form</b>	Herbaceous perennials to annuals

### Characteristics

<b>Pollen class</b>	Stephanocolpate, 5-9(-12) colpi
<b>Pollen grain shape</b>	Sphaeroid to prolate, mostly polar barrel-shaped flattened
<b>Pollen grain size</b>	14.2-38.9 µm
<b>Aperture</b>	
<b>Sculpture</b>	Microreticulate (± scabrate, psilate), brochi max. 1 µm
<b>Sporoderm</b>	Exine 1.2-1.8 µm, tectate


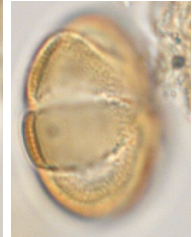


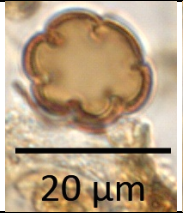
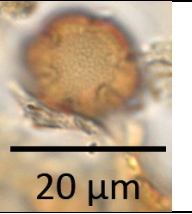
***Salvia pratensis* group****General remarks**

<b>Plant family</b>	Lamiaceae
<b>Common names (English/German)</b>	Meadow clary Wiesensalbei
<b>Palynomorph group</b>	Non-arboreal pollen
<b>Growth form</b>	Herbaceous perennials

**Characteristics**

<b>Pollen class</b>	Stephanocolpate, 6(-8) colpi
<b>Pollen grain shape</b>	Sphaeroid, polar elliptic
<b>Pollen grain size</b>	27.6-72.0 µm
<b>Aperture</b>	
<b>Sculpture</b>	Reticulate, macrobrochi 2.5-4.0 µm, 10-15 microbrochi/lumen
<b>Sporoderm</b>	Exine 1.5-2.0 µm

*Salvia verticillata*

 		 	
20 µm		20 µm	
TP-2009 121.85 m		TP-2009 121.45 m	
 			
20 µm			
TP-2009 125.04 m			

**General remarks**

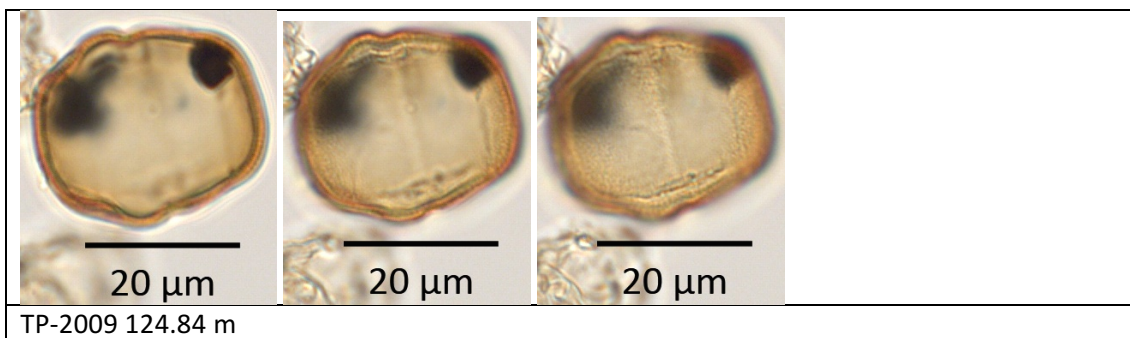
<b>Plant family</b>	Lamiaceae
<b>Common names (English/German)</b>	Quirlblütiger Salbei
<b>Palynomorph group</b>	Non-arboreal pollen
<b>Growth form</b>	Herbaceous perennials

**Characteristics**

<b>Pollen class</b>	Stephanocolpate, 6 colpi
<b>Pollen grain shape</b>	Sphaeroid
<b>Pollen grain size</b>	20.9-28.3 µm
<b>Aperture</b>	Intercolpi with 2 opposite broad and 4 thin
<b>Sculpture</b>	Reticulate, macrobrochi max. 1.5 µm, 2-4 microbrochi/lumen
<b>Sporoderm</b>	

# Stephanocolporatae

### *Pulmonaria* type



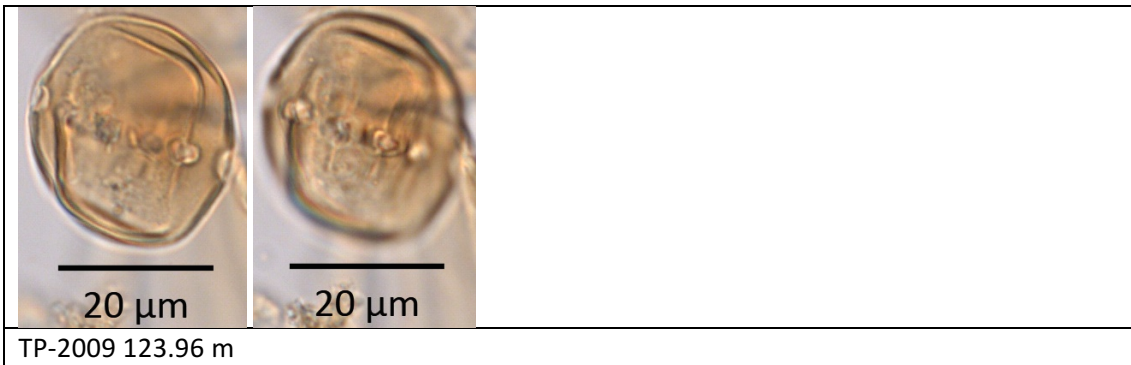
#### General remarks

<b>Plant family</b>	Boraginaceae
<b>Common names (English/German)</b>	Lungwort Lungenkräuter
<b>Palynomorph group</b>	Non-arboreal pollen
<b>Growth form</b>	Herbaceous perennials

#### Characteristics

<b>Pollen class</b>	Stephanocolporate, 4(-5) pori and colpi
<b>Pollen grain shape</b>	Sphaeroid or prolate, polar square or rounded, eq. with parallel sides, polar fields rounded or flat
<b>Pollen grain size</b>	27.5-49.5 µm
<b>Aperture</b>	Pori eq. elongated, rhomboid, (4-)5.5-6 x 9-10.5 µm Colpi short
<b>Sculpture</b>	Eq. reticulate
<b>Sporoderm</b>	Exine 1.0-1.5 µm Columellae thin

## *Symphytum*



### General remarks

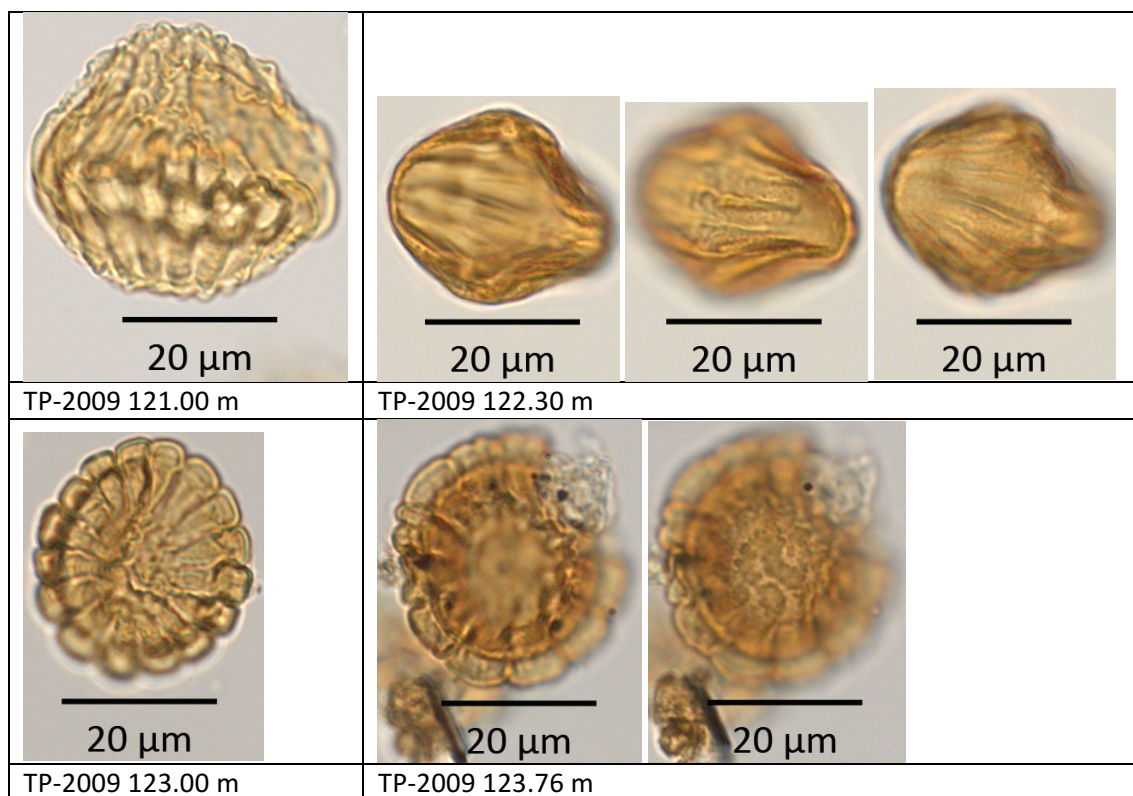
<b>Plant family</b>	Boraginaceae
<b>Common names (English/German)</b>	Comfrey Beinwell
<b>Palynomorph group</b>	Non-arboreal pollen
<b>Growth form</b>	Herbaceous perennials

### Characteristics

<b>Pollen class</b>	Stephanocolporate, (7-)8-10(-11) pori and colpi
<b>Pollen grain shape</b>	Sphaeroid to prolate, eq. elliptic, parallel sides or eq. slightly constricted
<b>Pollen grain size</b>	20.5-32.5 μm
<b>Aperture</b>	Pori circular to slightly eq. elongated (3.0 x 3.0-3.5 μm) or elliptic (1.5-2 x 3.0-4.0 μm), with costae Colpi thin and short, with costae
<b>Sculpture</b>	Psilate
<b>Sporoderm</b>	Exine 1 μm Columellae not visible



## *Utricularia*



### General remarks

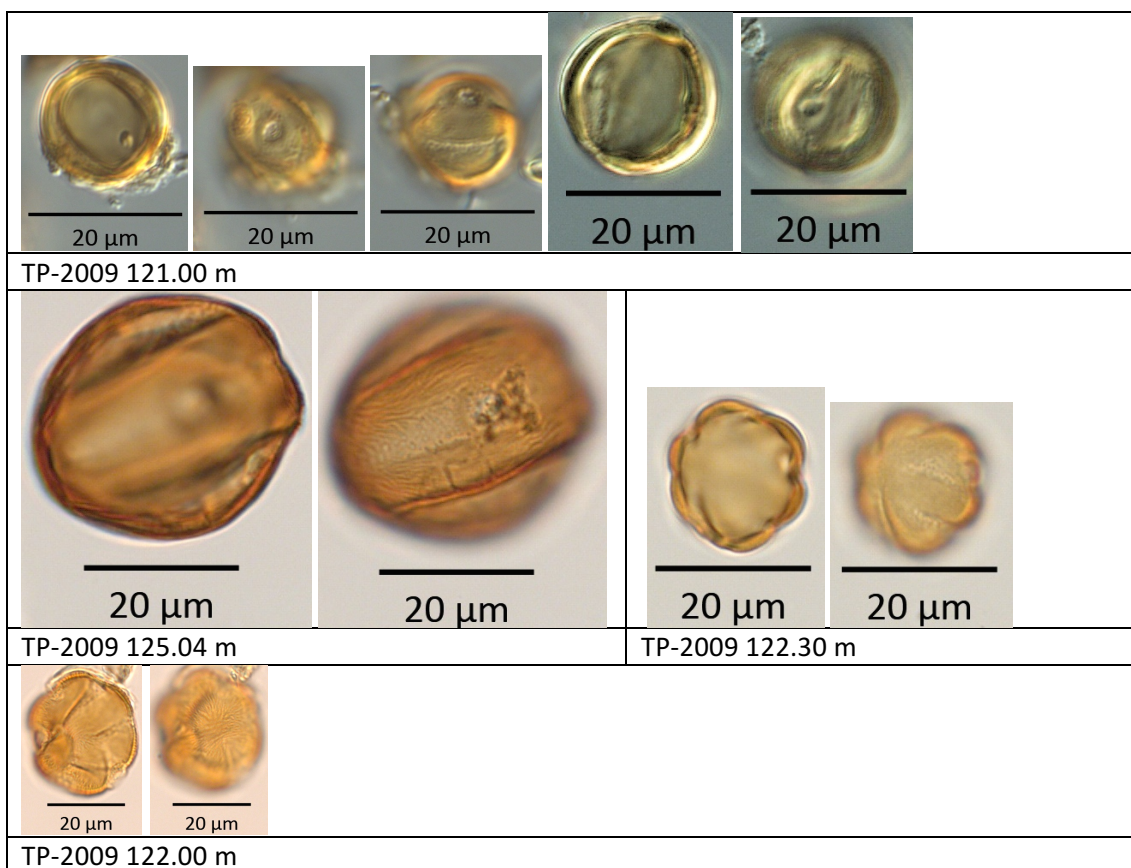
<b>Plant family</b>	Lentibulariaceae
<b>Common names (English/German)</b>	Bladderworts Wasserschläuche
<b>Palynomorph group</b>	<a href="#">Aquatic</a>
<b>Growth form</b>	Herbaceous perennials or annuals

### Characteristics

<b>Pollen class</b>	Stephanocolporate, 10-18 colpi
<b>Pollen grain shape</b>	Sphaeroid to oblate, polar rounded to elliptic, eq. discus-shaped, rhomboid, barrel-shaped or elliptic, often heteropolar; eq. bulged
<b>Pollen grain size</b>	19.5-48.0 µm
<b>Aperture</b>	Colpi thin Intercolpi 5-7 µm broad
<b>Sculpture</b>	Psilate or verrucate
<b>Sporoderm</b>	Exine 1.3-1.5 µm
<b>Ecology</b>	High abundances indicate water depth ca. 0.5-1 m (Harrison & Digerfeldt 1990)

# Heterocolpatae

## Lythrum



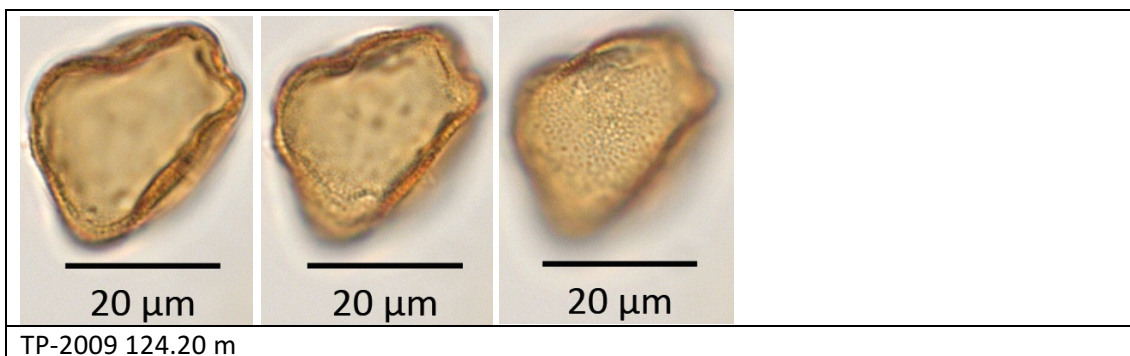
### General remarks

<b>Plant family</b>	Lythraceae
<b>Common names (English/German)</b>	Loosestrife Blutweideriche
<b>Palynomorph group</b>	<a href="#">Aquatic</a>
<b>Growth form</b>	Herbaceous perennials to annuals or subshrubs

### Characteristics

<b>Pollen class</b>	Heterocolpate, 3 porate colpi and 3 non-porate colpi
<b>Pollen grain shape</b>	Sphaeroid to slightly prolate
<b>Pollen grain size</b>	Pollentrimorphism, linked to flowertrimorphism: long stamina = large PG (36.5-50 µm), medium-sized stamina = medium-sized PG (23.0-32.8 µm), short stamina = small PG (15.0-24.8 µm)
<b>Aperture</b>	Pori: large PG 5.5-7.5 µm, medium PG 3.3-5.3 µm, small PG 3.3-5.0 µm; circular to meridional elliptic, mostly with costae Colpi: large PG 3.3-5.5 µm, medium PG 3.5 µm, small PG 4.5 µm broad; porate colpi longer than non-porate colpi Intercolpi 10.0-11.5 µm
<b>Sculpture</b>	Striate, max. 1 µm, meridional
<b>Sporoderm</b>	Exine 2 µm, Columellae not visible

# Periporatae

***Buxus***

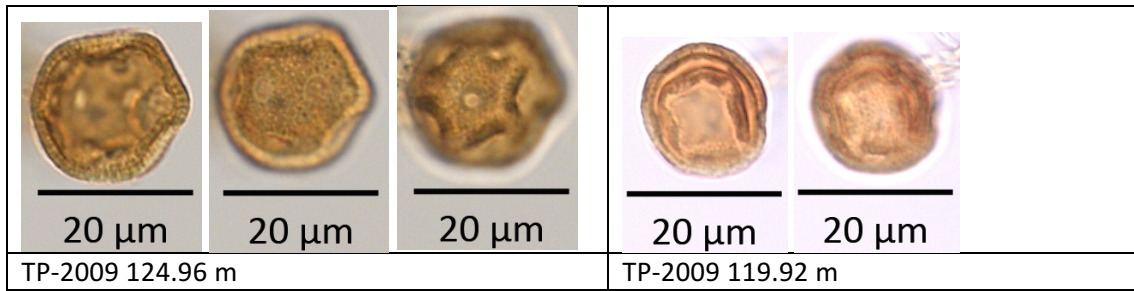
TP-2009 124.20 m

**General remarks**

<b>Plant family</b>	Buxaceae
<b>Common names (English/German)</b>	Box Buchsäume
<b>Palynomorph group</b>	Arboreal pollen
<b>Growth form</b>	Indeciduous tree or shrub

**Characteristics**

<b>Pollen class</b>	Periporate
<b>Pollen grain shape</b>	Rounded to elongated, poorly dimensionally stable
<b>Pollen grain size</b>	29.0-42.0 µm
<b>Aperture</b>	Pori 1.5-2.0 µm, rounded to irregular
<b>Sculpture</b>	Reticulate, brochi 1-2 µm, muri broad and high, lumina narrow (<1 µm)
<b>Sporoderm</b>	Exine 2.0-2.5 µm Columellae thin and short

*Anemone coronaria***General remarks**

<b>Plant family</b>	Ranunculaceae
<b>Common names (English/German)</b>	Poppy anemone Kronen-Anemone
<b>Palynomorph group</b>	Non-arboreal pollen
<b>Growth form</b>	Herbaceous perennials

**Characteristics**

<b>Pollen class</b>	Periporate
<b>Pollen grain shape</b>	Mostly 10-angular
<b>Pollen grain size</b>	28.5-33.0 µm
<b>Aperture</b>	Pori 5-6 µm Pore distance 9-10 µm
<b>Sculpture</b>	Microechinate, 1 microechinus/columella
<b>Sporoderm</b>	Exine ca. 2.5 µm Columellae irregular, 0.8-1.1 µm, columellae distance 1.5-2.5 µm



## *Calystegia*






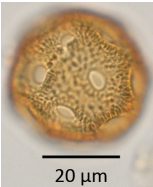


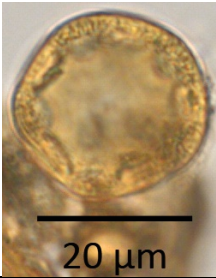
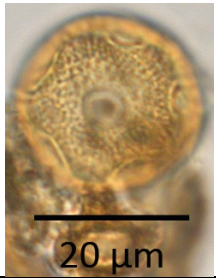


### General remarks

<b>Plant family</b>	Convolvulaceae
<b>Common names (English/German)</b>	Bindweed, morning glory Zaunwinden
<b>Palynomorph group</b>	Non-arboreal pollen
<b>Growth form</b>	Creeper, herbaceous perennials to annuals

### Characteristics

<b>Pollen class</b>	Periporate
<b>Pollen grain shape</b>	Sphaeroid
<b>Pollen grain size</b>	74.5-104.3 µm
<b>Aperture</b>	Pori rounded (7-9 µm), elongated (5-8 x 10-15 µm) or irregular, recessed Pore distance 20-25 µm
<b>Sculpture</b>	Psilate, tectum perforatum
<b>Sporoderm</b>	Exine 4-6 µm, endexine and tectum thin Columellae 3-4.5 µm
<b>Ecology</b>	Restricted to temperate and subtropical regions

***Cerastium* type**

 		 	
TP-2009 121.61 m		TP-2009 122.52 m	
 		 	
TP-2009 122.44 m		TP-2009 123.80 m	
 			
TP-2009 124.84 m			

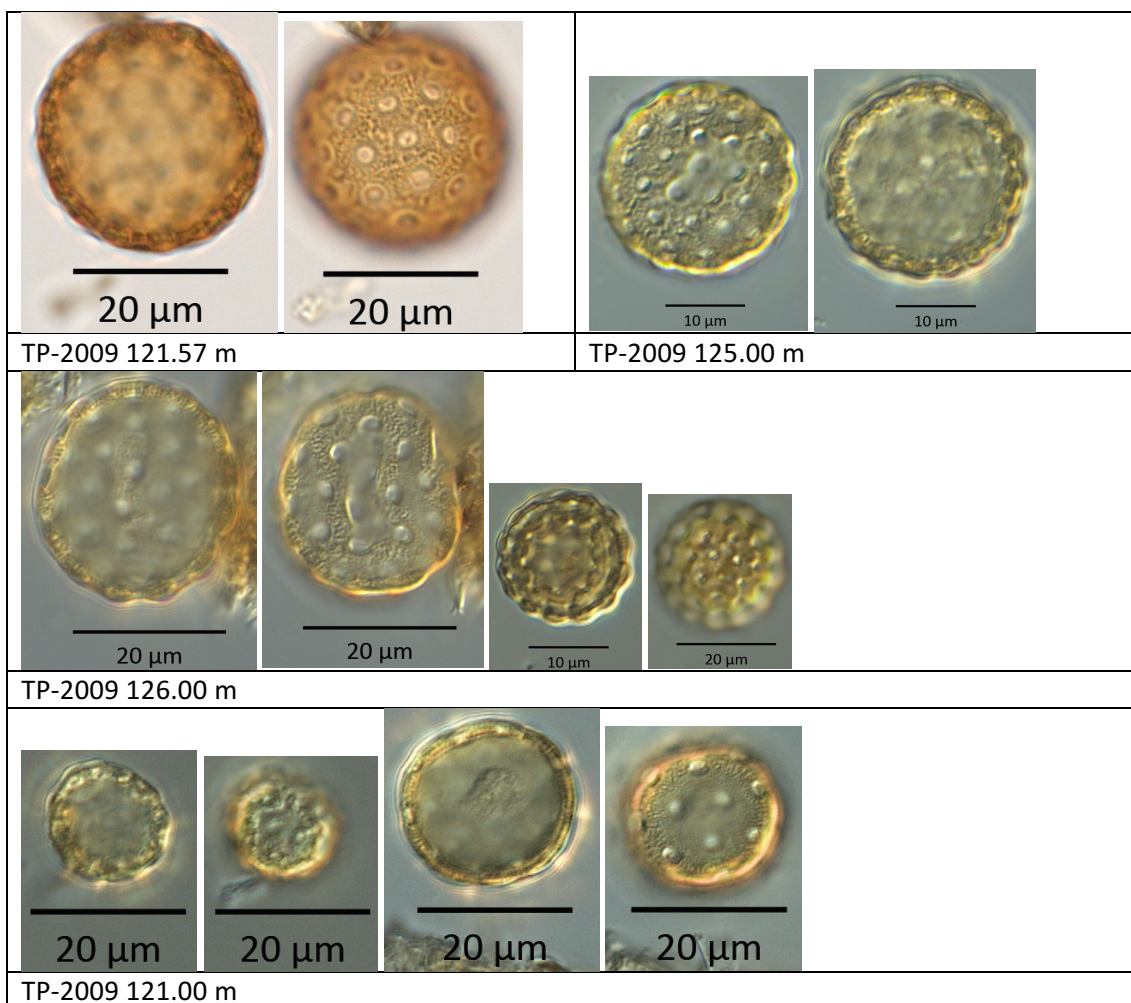
**General remarks**

<b>Plant family</b>	Caryophyllaceae
<b>Common names (English/German)</b>	Mouse-ear chickweed Hornkräuter
<b>Palynomorph group</b>	Non-arboreal pollen
<b>Growth form</b>	Herbaceous perennials to annuals

**Characteristics**

<b>Pollen class</b>	Periporate, 8-38 pori
<b>Pollen grain shape</b>	Rounded-angular
<b>Pollen grain size</b>	21.5-59.8 µm
<b>Aperture</b>	Pori 1.5-7.7 µm, with annulus Pore distance 5-20 µm Interporium 3-14 µm
<b>Sculpture</b>	Microreticulate and scabrate
<b>Sporoderm</b>	Exine 2.2-4.5 µm

## Chenopodiaceae



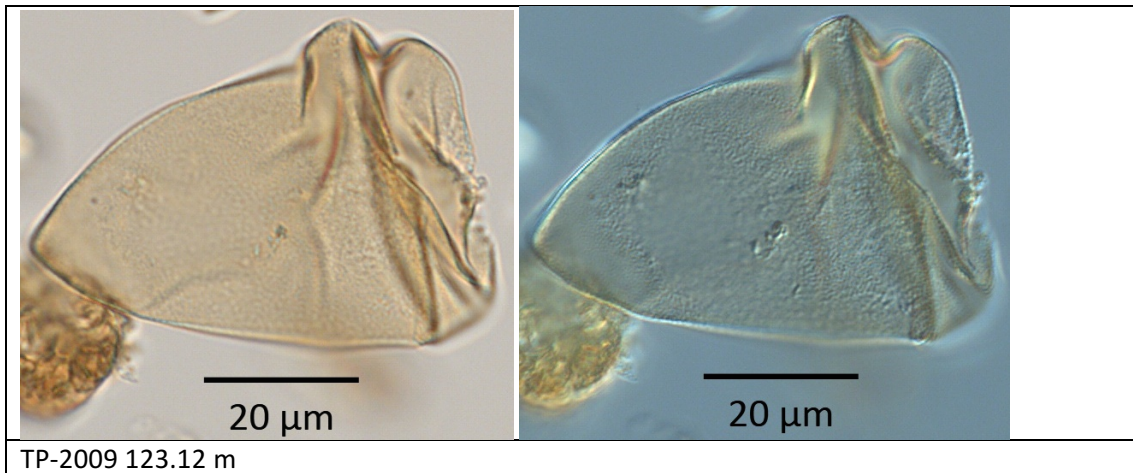
### General remarks

<b>Plant family</b>	Chenopodiaceae
<b>Common names (English/German)</b>	Goosefoot family Gänsefußgewächse
<b>Palynomorph group</b>	Non-arboreal pollen
<b>Growth form</b>	Herbaceous perennials to annuals, subshrubs

### Characteristics

<b>Pollen class</b>	Periporate, 25-110 pores
<b>Pollen grain shape</b>	Sphaeroid
<b>Pollen grain size</b>	17.5-43.5 µm
<b>Aperture</b>	Pori 1.1-3.0(-4.0 µm), with thin annulus Pore distance 4-7 µm Interporium 2-5 µm
<b>Sculpture</b>	Tectate, psilate (± scabrate)
<b>Sporoderm</b>	Exine 1.5-2.5(-2.9) µm Collumellae thin
<b>Ecology</b>	Steppe element indicating cold and/or dry steppe conditions; requires less moisture availability than <i>Artemisia</i> (El-Moslimany 1990, Li et al. 2010, Zhao et al. 2008)

### *Cladium* type



#### General remarks

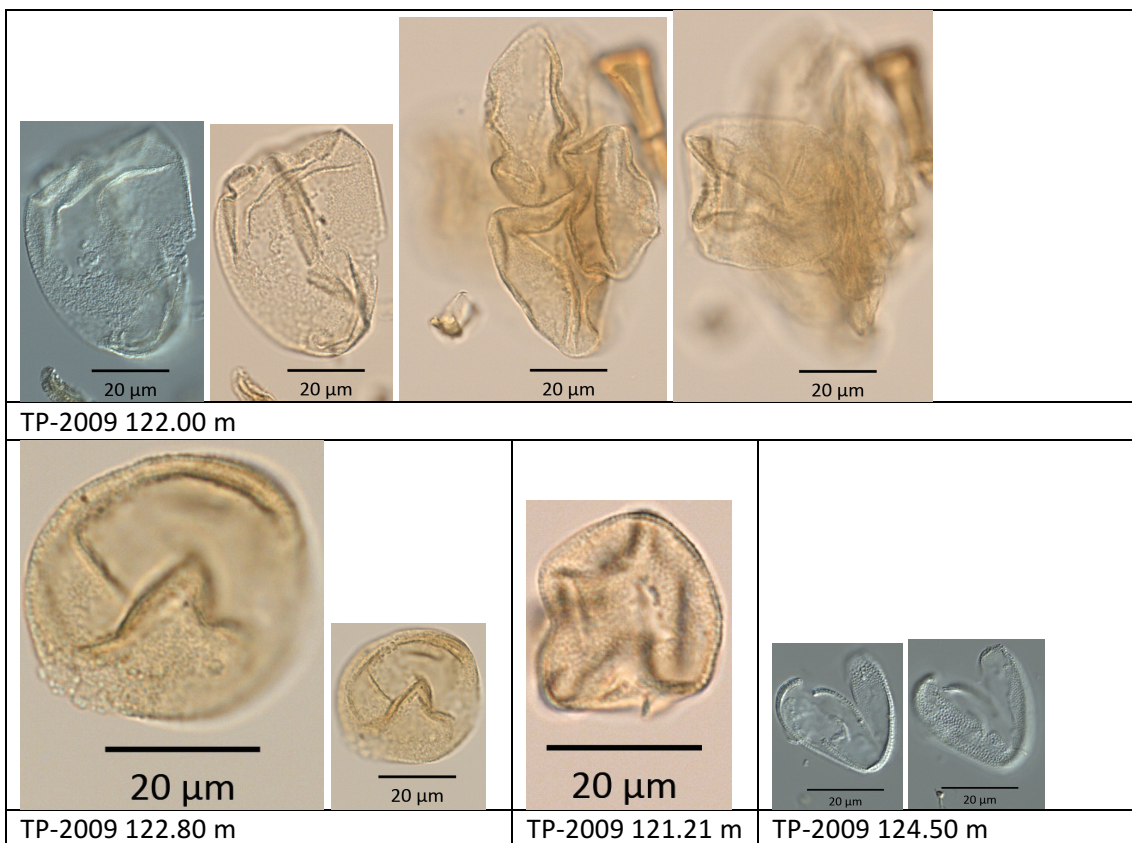
<b>Plant family</b>	Cyperaceae
<b>Common names (English/German)</b>	Fen-sedge Schneiden
<b>Palynomorph group</b>	Non-arboreal pollen
<b>Growth form</b>	Herbaceous perennials

#### Characteristics

<b>Pollen class</b>	Periporate
<b>Pollen grain shape</b>	Thin triangular
<b>Pollen grain size</b>	53.3-73.8 µm
<b>Aperture</b>	Pori 6-10 x 9-10 µm
<b>Sculpture</b>	Scabrate
<b>Sporoderm</b>	Exine 0.9-1.0 µm
<b>Ecology</b>	Cyperaceae demand more soil moisture than Poaceae and <i>Artemisia</i> (Li et al. 2010, Tang et al. 2009)



## Cyperaceae



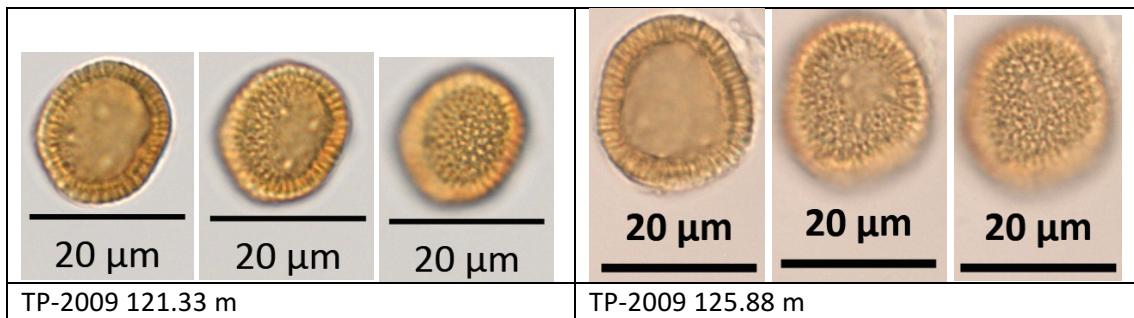
### General remarks

<b>Plant family</b>	Cyperaceae
<b>Common names (English/German)</b>	Sedges Sauergrasgewächse
<b>Palynomorph group</b>	Non-arboreal pollen
<b>Growth form</b>	Herbaceous perennials (mostly)

### Characteristics

<b>Pollen class</b>	Cryptotetrades; periporate, pericolpate or pericolporate (i. e. <i>Carex</i> ), 5-9 pori and/or colpi
<b>Pollen grain shape</b>	Conical, triangular, elongated or short, sac-like ( $\pm$ rounded-angular, rectangular)
<b>Pollen grain size</b>	22.3-73.8 $\mu\text{m}$
<b>Aperture</b>	
<b>Sculpture</b>	Scabrate, verrucate or rugulate, 1.5 $\mu\text{m}$ , tectum perforatum
<b>Sporoderm</b>	Exine 0.9-1.3 $\mu\text{m}$
<b>Ecology</b>	Peat former

## *Daphne*



### General remarks

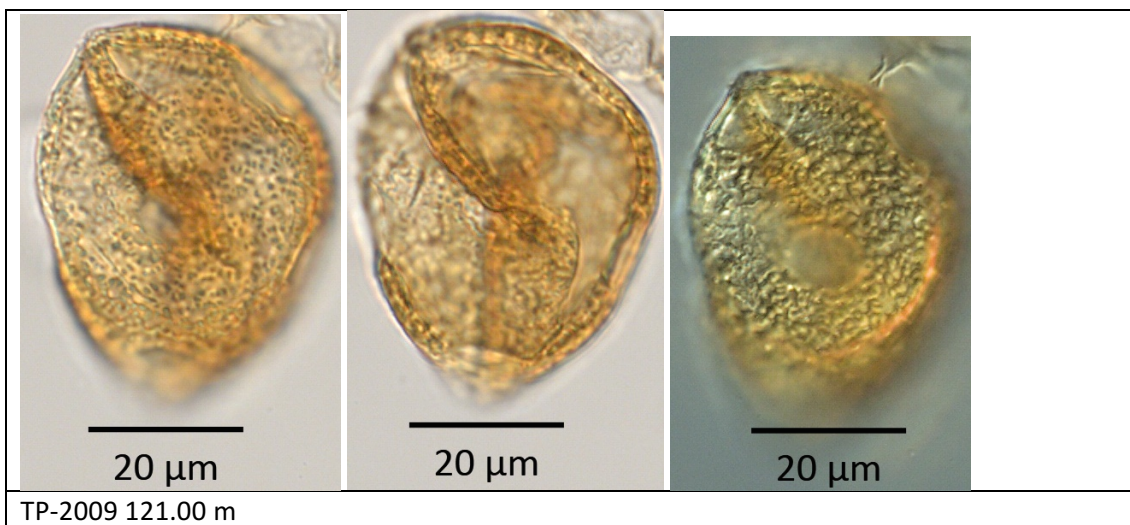
<b>Plant family</b>	Thymelaeaceae
<b>Common names (English/German)</b>	Daphne Seidelbast
<b>Palynomorph group</b>	Non-arboreal pollen
<b>Growth form</b>	Deciduous or indeciduous shrub or subshrub

### Characteristics

<b>Pollen class</b>	Periporate
<b>Pollen grain shape</b>	Sphaeroid ( $\pm$ egg-shaped to angular)
<b>Pollen grain size</b>	20.5-38.0 $\mu$ m
<b>Aperture</b>	Pori 1-2 $\mu$ m, pore distance 5-10 $\mu$ m, with low contrast
<b>Sculpture</b>	Reticulate to microreticulate, brochi 1.5-3.0 $\mu$ m, muri broad, lumina 1 $\mu$ m, distance of microechini 1.0-1.5(-2.0) $\mu$ m
<b>Sporoderm</b>	Exine 2.5-4.5 $\mu$ m, endexine 0.8-1.0 $\mu$ m Columellae max. 1.5 $\mu$ m long, 1 $\mu$ m thick Sporoderm thick-walled



## *Dianthus* type



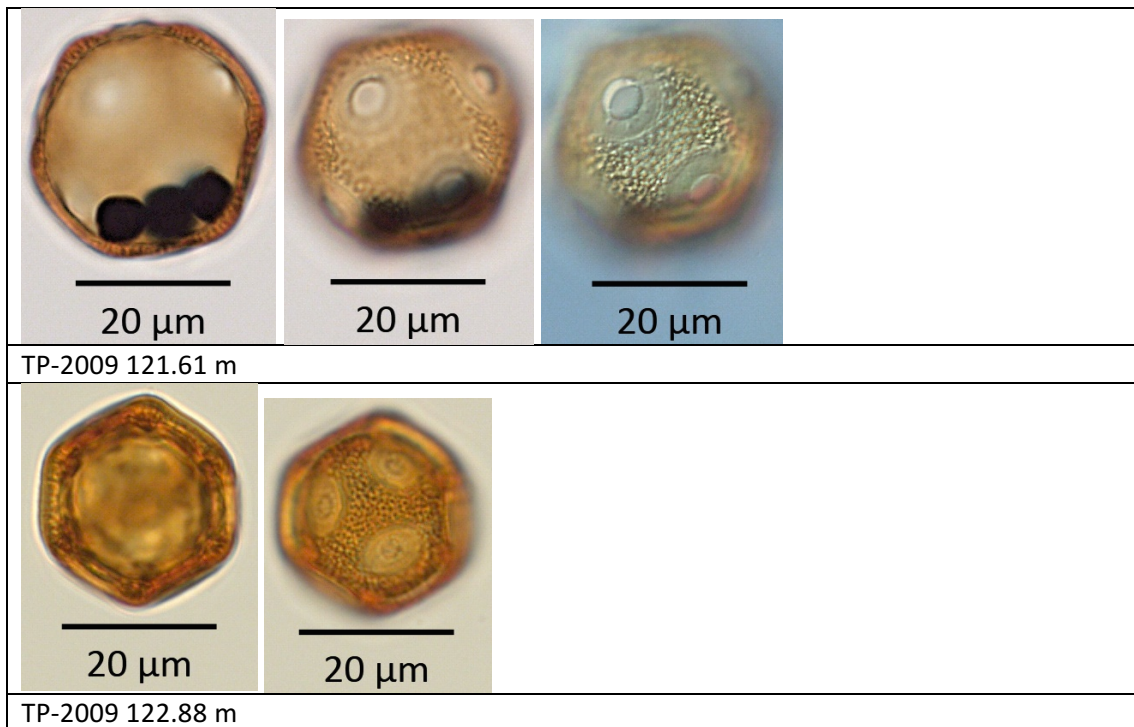
### General remarks

<b>Plant family</b>	Caryophyllaceae
<b>Common names (English/German)</b>	Pink, carnation, sweet william Nelken
<b>Palynomorph group</b>	Non-arboreal pollen
<b>Growth form</b>	Herbaceous biennials

### Characteristics

<b>Pollen class</b>	Periporate, 8-19 pori
<b>Pollen grain shape</b>	Rounded or rounded-angular
<b>Pollen grain size</b>	31.0-67.0 µm
<b>Aperture</b>	Pori 4.0-11.0 µm Pore distance 4.0-28.0 µm Interporium 8.0-20.0 µm
<b>Sculpture</b>	Microechinate, max. 1µm, tectum perforatum
<b>Sporoderm</b>	Exine (2.5-)3-4(-4.5) µm

### *Gypsophila repens* type



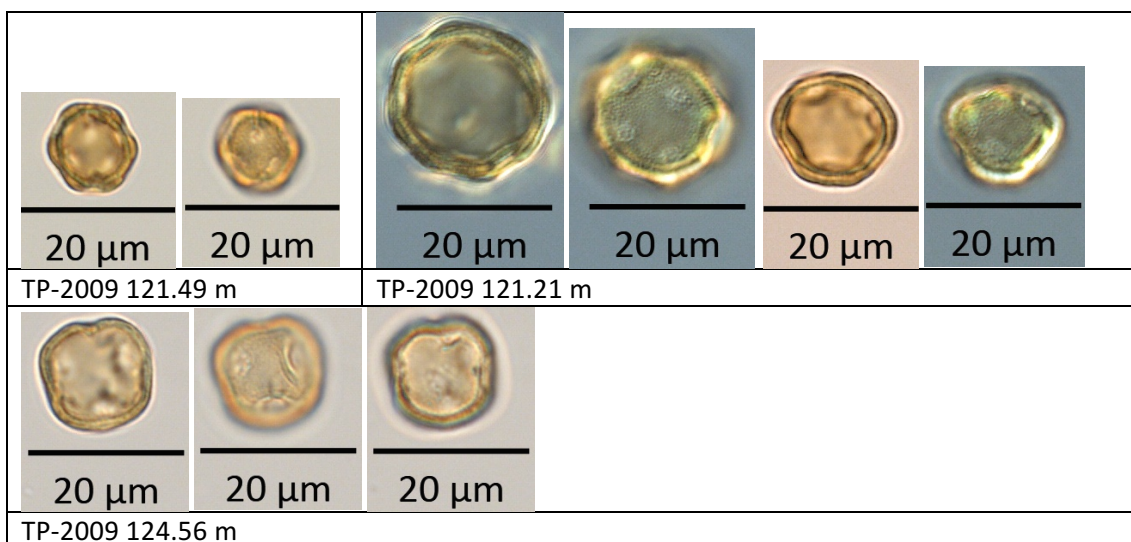
#### General remarks

<b>Plant family</b>	Caryophyllaceae
<b>Common names (English/German)</b>	Creeping baby's-breath Kriechendes Gipskraut
<b>Palynomorph group</b>	Non-arboreal pollen
<b>Growth form</b>	Herbaceous perennials

#### Characteristics

<b>Pollen class</b>	Periporate, (10-)12(-13) pori
<b>Pollen grain shape</b>	Rounded-angular, 8-angular
<b>Pollen grain size</b>	23.5-37.3 µm
<b>Aperture</b>	Pori 3-5 µm, with annulus Pore distance 11-15 µm Interporium 5-8 µm
<b>Sculpture</b>	Scabrate or microechinate, tectum perforatum
<b>Sporoderm</b>	Exine 2.8-3.8 µm

### *Herniaria* group



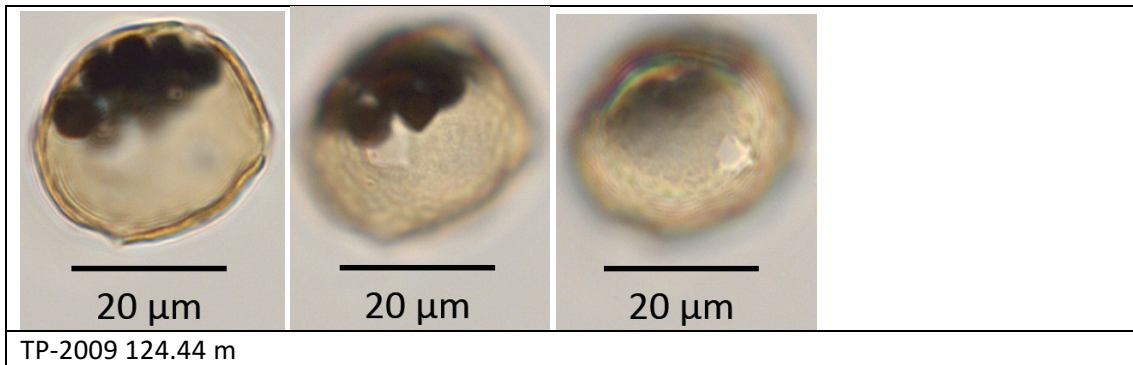
#### General remarks

<b>Plant family</b>	Caryophyllaceae
<b>Common names (English/German)</b>	Ruptureworts Bruchkräuter
<b>Palynomorph group</b>	Non-arboreal pollen
<b>Growth form</b>	Herbaceous annuals or perennials

#### Characteristics

<b>Pollen class</b>	Periporate, 4-11 pori
<b>Pollen grain shape</b>	Angular to rounded-angular; 4 pori triangular, 6 pori rectangular, 7 pori pentagonal
<b>Pollen grain size</b>	11.0-21.0 µm
<b>Aperture</b>	Pori (3.0-)3.5-6.0 µm, ± with annulus
<b>Sculpture</b>	Psilate, ± tectum perforatum
<b>Sporoderm</b>	Exine 1.3-2.2 µm

### *Littorella* type



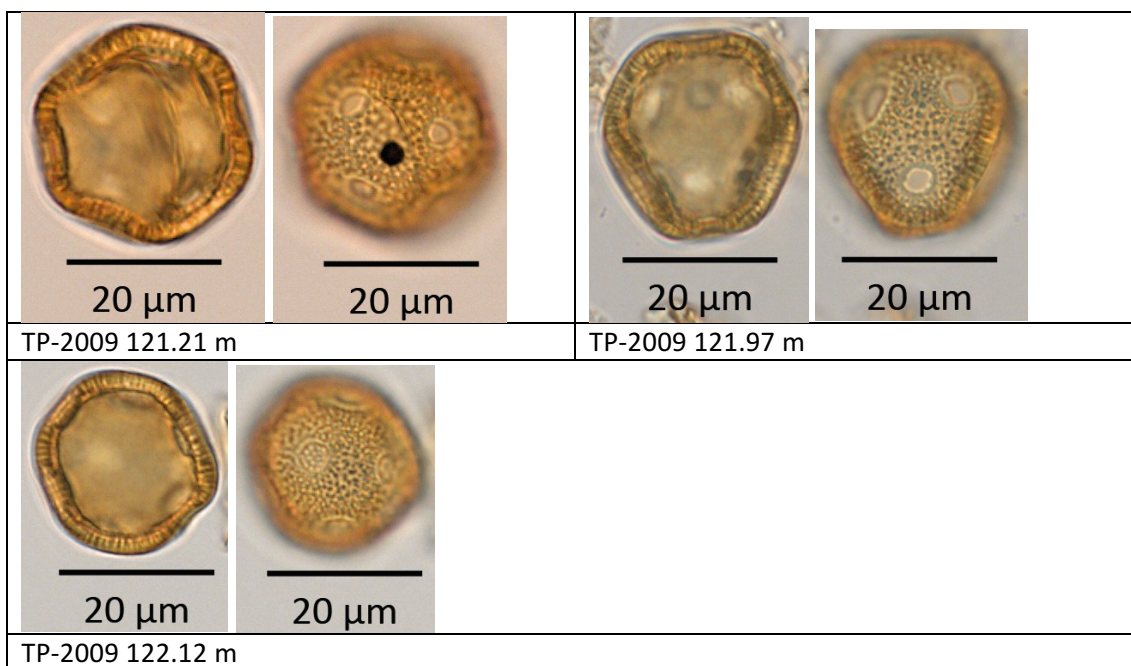
#### General remarks

<b>Plant family</b>	Plantaginaceae
<b>Common names (English/German)</b>	Littorella Strandlinge
<b>Palynomorph group</b>	Non-arboreal pollen
<b>Growth form</b>	Indeciduous herbaceous perennials

#### Characteristics

<b>Pollen class</b>	Periporate, 5-17 pori
<b>Pollen grain shape</b>	Prolate
<b>Pollen grain size</b>	32.5-43.5 µm
<b>Aperture</b>	Pori 3.5-5.5(-7.0 µm), irregular, operculate
<b>Sculpture</b>	Verrucate
<b>Sporoderm</b>	Exine 0.8-1.2 µm
<b>Ecology</b>	Low-nutrient indicator, high abundances indicate water depth ca. <4.5 m (Harrison & Digerfeldt 1990)

### *Minuartia verna* type

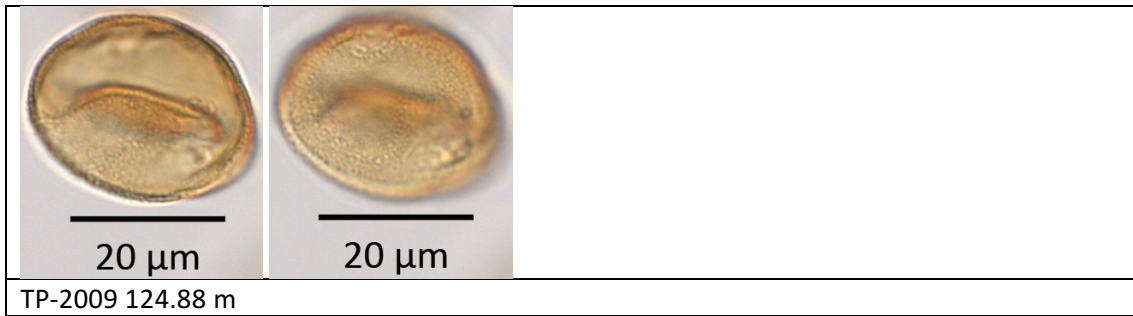


#### General remarks

<b>Plant family</b>	Caryophyllaceae
<b>Common names (English/German)</b>	Sandworts Mieren
<b>Palynomorph group</b>	Non-arboreal pollen
<b>Growth form</b>	Herbaceous perennials to annuals

#### Characteristics

<b>Pollen class</b>	Periporate, 11-26 pores
<b>Pollen grain shape</b>	Sphaeroid-circular to prolate, sphaeroid-angular, 6-angular
<b>Pollen grain size</b>	19.5-44.3 µm
<b>Aperture</b>	Pori 2-9.5 µm, with 0.4-1.0 µm broad annulus, opercula granulous Pore distance 7-18.5 µm Interporium 3.5-11 µm
<b>Sculpture</b>	Scabrate, microreticulate, brochi 1.0(-1.8) µm
<b>Sporoderm</b>	Exine 2.0-3.7 µm Columellae 0.6-1.5 µm

*Papaver argemone***General remarks**

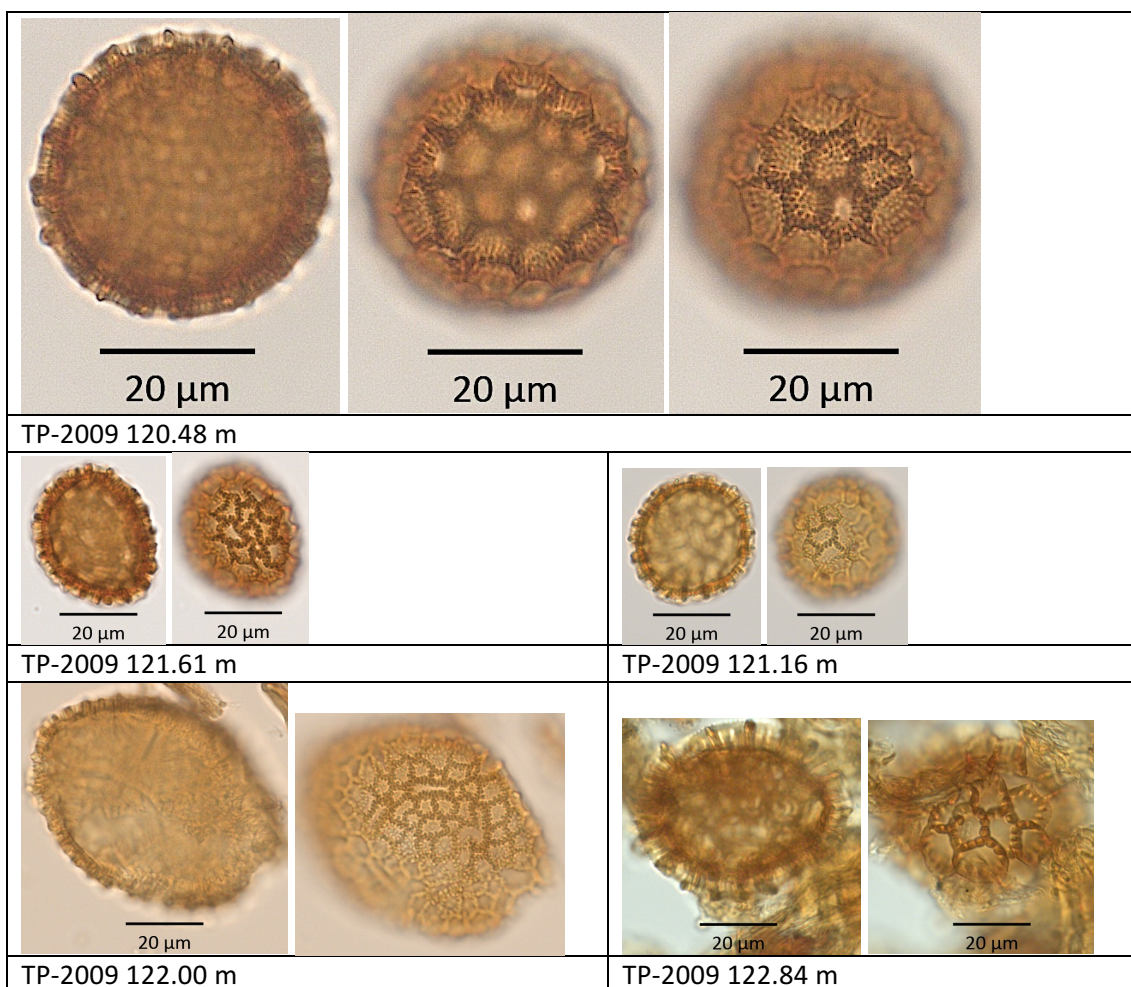
<b>Plant family</b>	Papaveraceae
<b>Common names (English/German)</b>	Long pricklyhead poppy, pale poppy Sand-Mohn
<b>Palynomorph group</b>	Non-arboreal pollen
<b>Growth form</b>	Herbaceous annuals (± biennials)

**Characteristics**

<b>Pollen class</b>	Periporate, 7-8 pori
<b>Pollen grain shape</b>	Sphaeroid, poorly dimensionally stable
<b>Pollen grain size</b>	33.3-44.0 µm
<b>Aperture</b>	Pori 8-13 µm, recessed, pore distances irregular, 15-20 µm
<b>Sculpture</b>	Microechinate, tectum perforatum
<b>Sporoderm</b>	Exine 1.3-1.8 µm Columellae in groups



***Persicaria maculosa* type (= *Polygonum persicaria* type)**



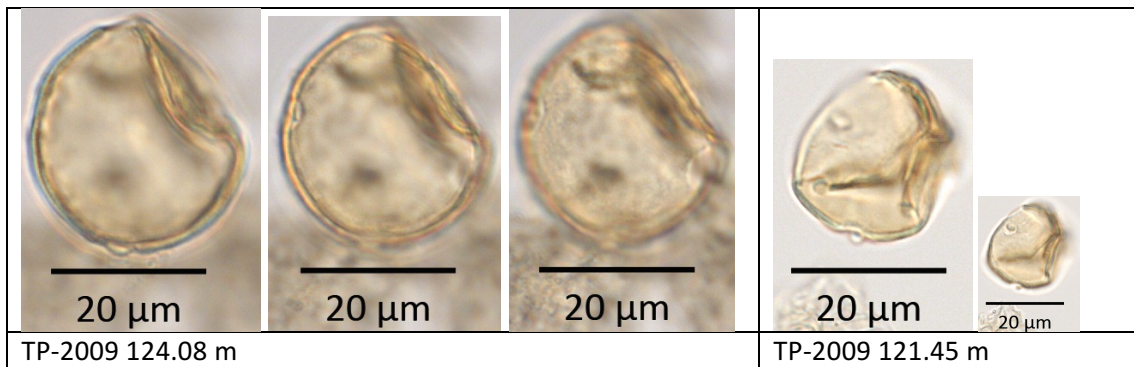
**General remarks**

<b>Plant family</b>	Polygonaceae
<b>Common names (English/German)</b>	Lady's thumb, Jesusplant, redshank Floh-Knöterich
<b>Palynomorph group</b>	Non-arboreal pollen
<b>Growth form</b>	Herbaceous annuals

**Characteristics**

<b>Pollen class</b>	Periporate
<b>Pollen grain shape</b>	Sphaeroid-globose ( $\pm$ elongated)
<b>Pollen grain size</b>	37.0-63.8 $\mu$ m
<b>Aperture</b>	Pori 2-3.5 $\mu$ m, in most of the lumina
<b>Sculpture</b>	Reticulate, brochi 5-13 $\mu$ m, muri 1-2 $\mu$ m broad, lumina with 1.5 x 0.7 $\mu$ m large bacula
<b>Sporoderm</b>	Exine 4.5-6.0 $\mu$ m dupli- to triplocolumellate

## *Plantago albicans*



### General remarks

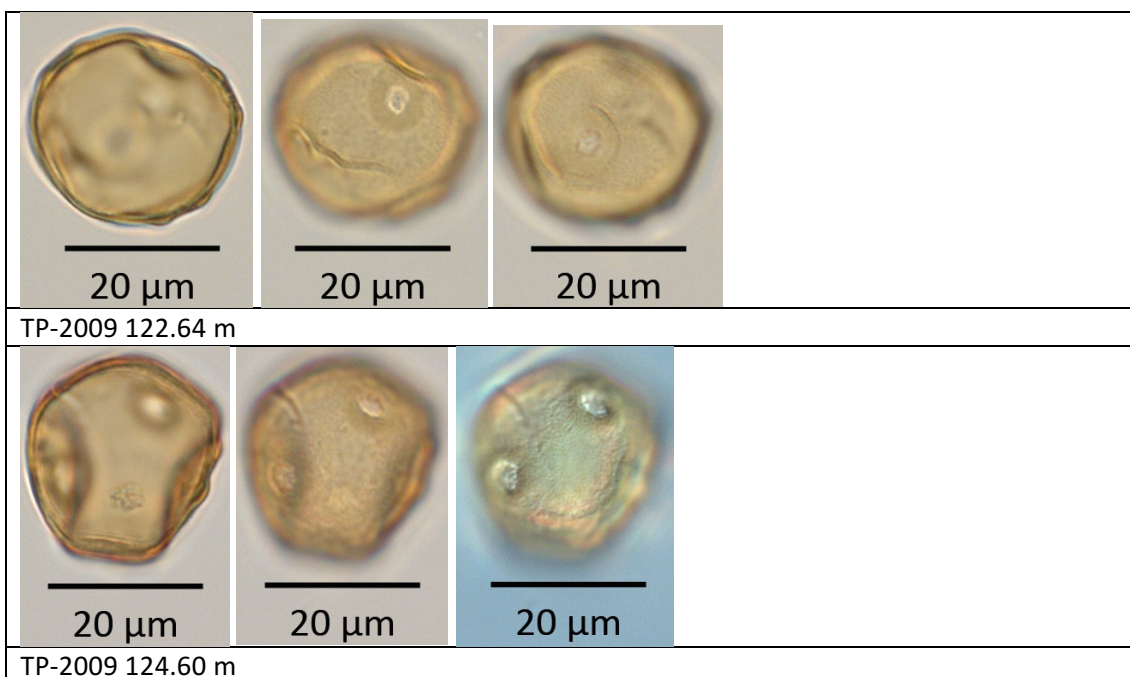
<b>Plant family</b>	Plantaginaceae
<b>Common names (English/German)</b>	Weißlicher Wegerich
<b>Palynomorph group</b>	Non-arboreal pollen
<b>Growth form</b>	Herbaceous perennials to annuals

### Characteristics

<b>Pollen class</b>	Periporate, 9-13 pori
<b>Pollen grain shape</b>	Sphaeroid-globose to slightly prolate
<b>Pollen grain size</b>	32.5-45.0 µm
<b>Aperture</b>	Pori (2.0-)3.0-5.0 µm, circular or elliptic (2-3 x 4-5 µm), operculate, no annulus
<b>Sculpture</b>	Verrucate, 1-3 µm
<b>Sporoderm</b>	Exine 1.0-1.3 µm

<i>Plantago</i> type	Characteristics
<i>Littorella</i> type	Prolate, very verrucate, operculate
<i>Plantago albicans</i>	High operculus, verrucate, no annulus
<i>Plantago coronopus</i> type	High annulus, verrucate, operculate
<i>Plantago lanceolata</i> type	± small pori, verrucate, with annulus, operculate
<i>Plantago major/media</i> type	Operculate, very verrucate
<i>Plantago maritima</i> type	Flat annulus, large pori, scabrate or verrucate, operculate
<i>Plantago tenuiflora</i> type	± small pori, scabrate or verrucate, operculate, no annulus

***Plantago coronopus* type**



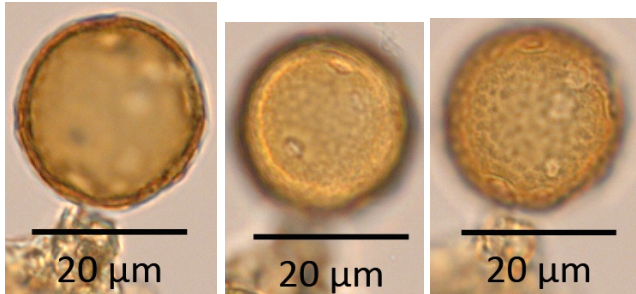




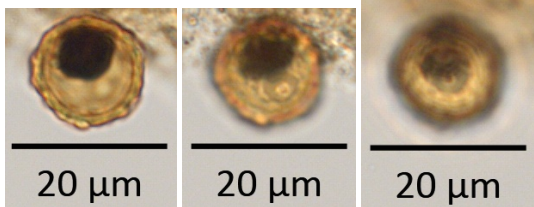

**General remarks**

<b>Plant family</b>	Plantaginaceae
<b>Common names (English/German)</b>	Minutina Krähenfuß-Wegerich
<b>Palynomorph group</b>	Non-arboreal pollen
<b>Growth form</b>	Herbaceous perennials or annuals

**Characteristics**

<b>Pollen class</b>	Periporate, (5-)6-8 pori
<b>Pollen grain shape</b>	Sphaeroid-globose to slightly prolate
<b>Pollen grain size</b>	24.0-32.3 µm
<b>Aperture</b>	Pori (2.2-)3.0-4.5 µm, operculate, with distinct annuli ( $\pm$ costae), 1.7-2.5 µm
<b>Sculpture</b>	Verrucate, 1-2 µm
<b>Sporoderm</b>	Exine 1.0-1.2 µm

*Plantago lanceolata* type

			
TP-2009 122.00 m			TP-2009 121.08 m
			
TP-2009 124.92 m			TP-2009 121.08 m
			
TP-2009 121.53 m			
			
TP-2009 124.84 m			TP-2009 123.56 m

## General remarks

Plant family	Plantaginaceae
Common names (English/German)	Minutina Spitzwegerich
Palynomorph group	Non-arboreal pollen
Growth form	Herbaceous perennials

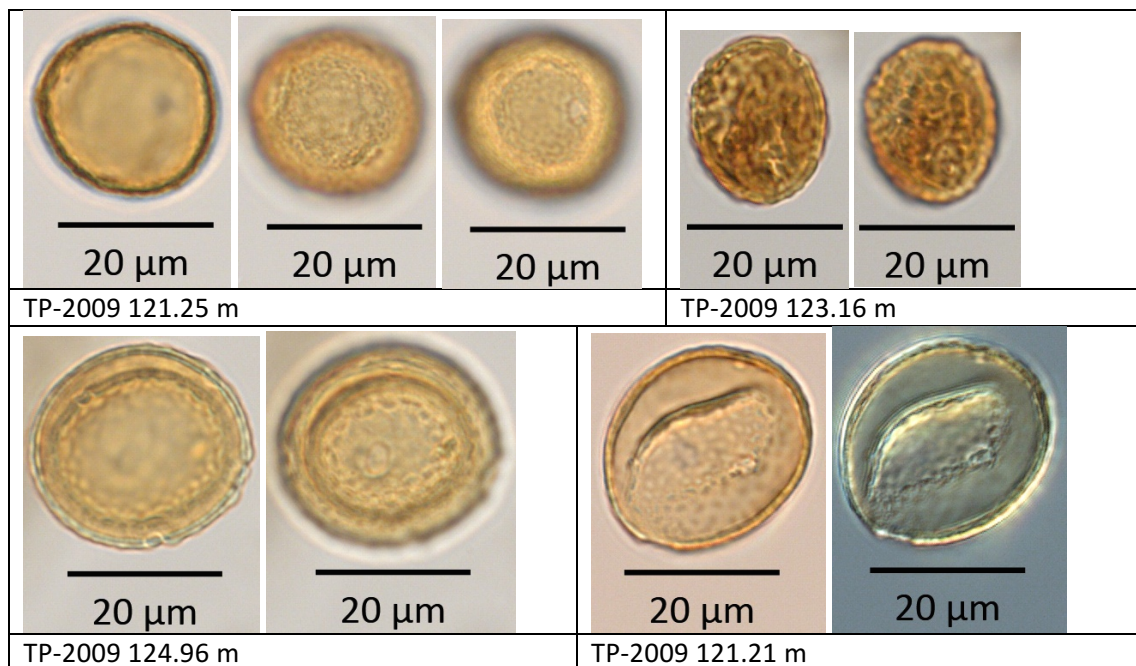
## Characteristics

Pollen class	Periporate, 9-16 pori
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<b>Pollen grain shape</b>	Sphaeroid-globose to slightly prolate
<b>Pollen grain size</b>	21.8-39.8 µm
<b>Aperture</b>	Pori 2.0-5.0 µm, operculate, with annulus, (1.0-)1.5-2.0(-2.5) µm
<b>Sculpture</b>	Verrucate, 1.5-4.5 µm
<b>Sporoderm</b>	Exine 0.8-1.2 µm



***Plantago major/media* type**



**General remarks**

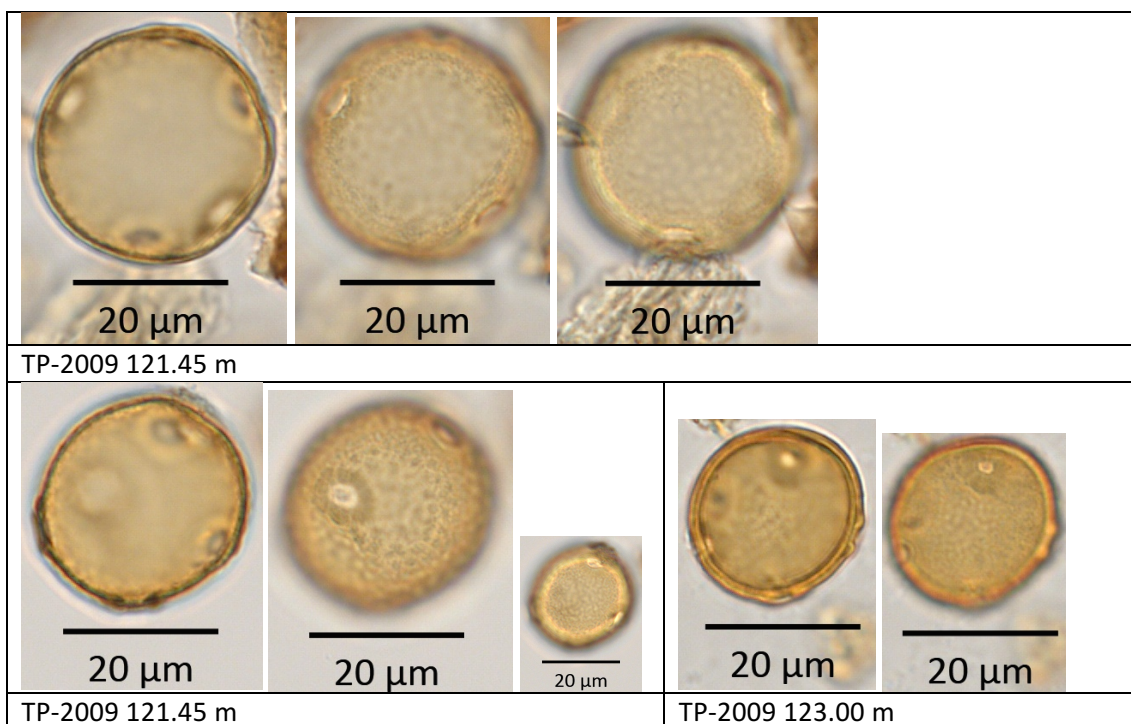
<b>Plant family</b>	Plantaginaceae
<b>Common names (English/German)</b>	Broadleaf plantain/hoary plantain Breitwegerich/Mittlerer Wegerich
<b>Palynomorph group</b>	Non-arboreal pollen
<b>Growth form</b>	Herbaceous perennials

**Characteristics**

<b>Pollen class</b>	Periporate, 6-11 pori
<b>Pollen grain shape</b>	Sphaeroid-globose to slightly prolate
<b>Pollen grain size</b>	19.5-33.8 µm
<b>Aperture</b>	Pori 3.0-6.0 µm, operculate
<b>Sculpture</b>	Verrucate, 1.5-4.5 µm
<b>Sporoderm</b>	Exine 1.0-1.6 µm



***Plantago maritima* type**



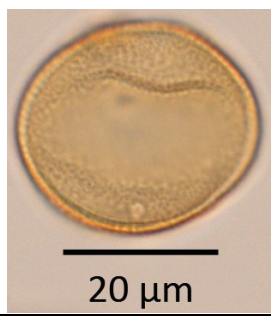




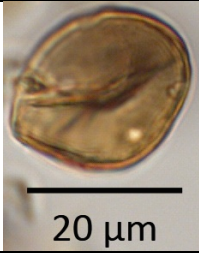

**General remarks**

<b>Plant family</b>	Plantaginaceae
<b>Common names (English/German)</b>	Sea plantain Strand-Wegerich
<b>Palynomorph group</b>	Non-arboreal pollen
<b>Growth form</b>	Deciduous herbaceous perennials

**Characteristics**

<b>Pollen class</b>	Periporate, (5-)6-10 pori
<b>Pollen grain shape</b>	Sphaeroid-globose to slightly prolate
<b>Pollen grain size</b>	27.0-40.0 µm
<b>Aperture</b>	Pori 3.5-5.0 µm, operculate, with flat, indistinct annulus
<b>Sculpture</b>	Verrucate, (1.0-)1.5-4.5 µm, scabrate
<b>Sporoderm</b>	Exine 1.0-1.2 µm

***Plantago tenuiflora* type**

 20 $\mu$ m		 20 $\mu$ m		
TP-2009 122.42 m				
 20 $\mu$ m			 20 $\mu$ m	 20 $\mu$ m
TP-2009 124.00 m			 20 $\mu$ m	 20 $\mu$ m
TP-2009 122.96 m			TP-2009 124.36 m	

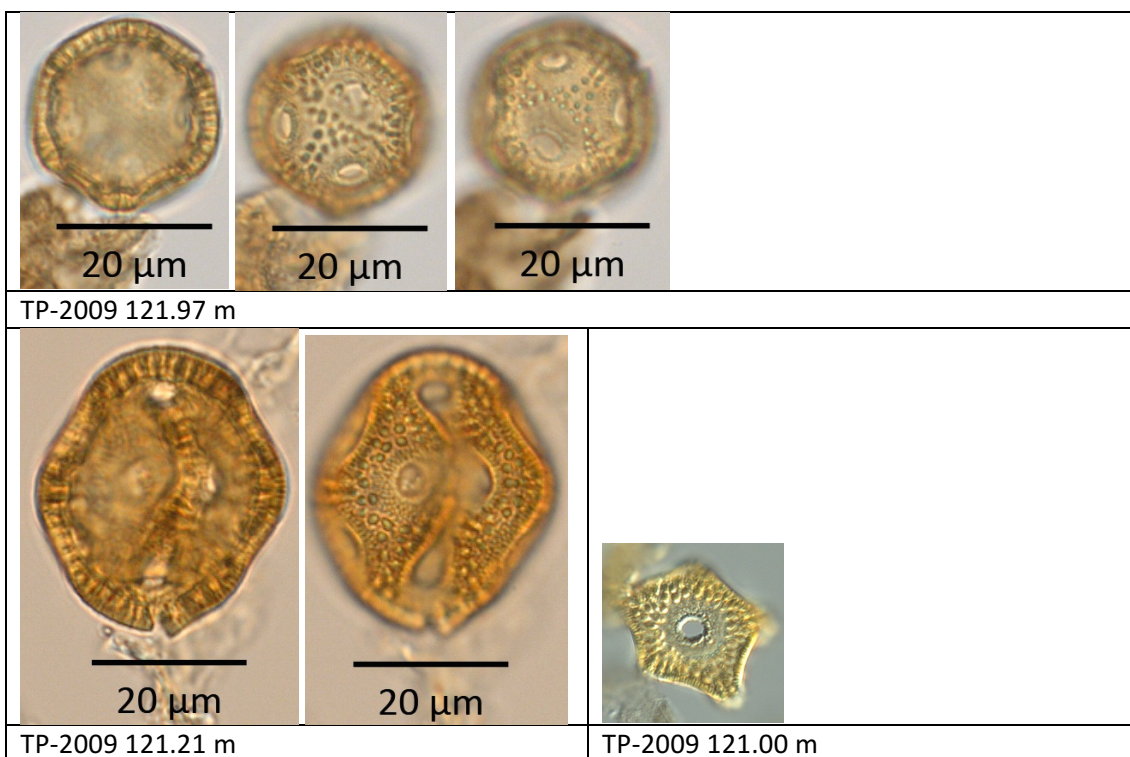
**General remarks**

<b>Plant family</b>	Plantaginaceae
<b>Common names (English/German)</b>	Sparse-flowered plantain Schmalblütiger Wegerich
<b>Palynomorph group</b>	Non-arboreal pollen
<b>Growth form</b>	Herbaceous perennials

**Characteristics**

<b>Pollen class</b>	Periporate, 9-12 pori
<b>Pollen grain shape</b>	Sphaeroid-globose to slightly prolate
<b>Pollen grain size</b>	20.8-25.3 µm
<b>Aperture</b>	Pori 2.8-3.3 µm, operculate, no annulus
<b>Sculpture</b>	Verrucate, 0.8-1.8 µm, scabrate
<b>Sporoderm</b>	Exine 0.8 µm

## *Scleranthus*



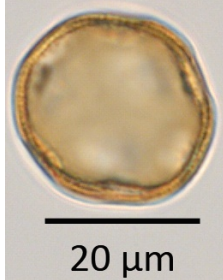

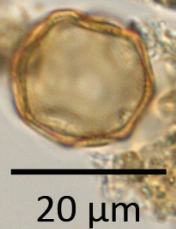
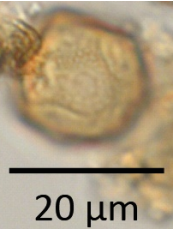


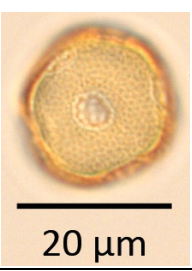


### General remarks

<b>Plant family</b>	Caryophyllaceae
<b>Common names (English/German)</b>	Knawels Knäuelkräuter
<b>Palynomorph group</b>	Non-arboreal pollen
<b>Growth form</b>	Herbaceous perennials, annuals or biennials

### Characteristics

<b>Pollen class</b>	Periporate, 12 pori
<b>Pollen grain shape</b>	Rounded or 8-angular
<b>Pollen grain size</b>	40.3-54.0 µm
<b>Aperture</b>	Pori 3.0-5.5 µm, with annulus Pore distance 13-18 µm Interporium 3.0-5.5 µm
<b>Sculpture</b>	Microreticulate, brochi max. 1 µm large, muri thin
<b>Sporoderm</b>	Exine 3.5-4.8 µm

***Thalictrum***

 		  		
TP-2009 121.25 m		TP-2009 122.08 m		
 		 		
TP-2009 121.21 m		TP-2009 121.56 m		

**General remarks**

<b>Plant family</b>	Ranunculaceae
<b>Common names (English/German)</b>	Meadow rue Wiesenrauten
<b>Palynomorph group</b>	Non-arboreal pollen
<b>Growth form</b>	Herbaceous perennials

**Characteristics**

<b>Pollen class</b>	Periporate, 6-14 pori
<b>Pollen grain shape</b>	Sphaeroid-angular
<b>Pollen grain size</b>	15.0-26.0 µm
<b>Aperture</b>	Pori 2.5-6.0 µm, circular (± elliptic), recessed
<b>Sculpture</b>	Scabrate, 0.5 µm
<b>Sporoderm</b>	Exine 1.5 µm

*Urtica pilulifera*



TP-2009 123.72 m

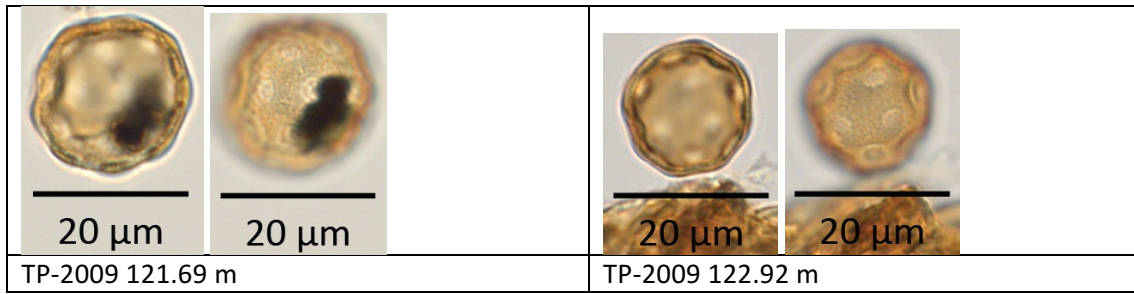
TP-2009 123.68 m

**General remarks**

<b>Plant family</b>	Urticaceae
<b>Common names (English/German)</b>	Roman nettle Pillen-Brennnessel
<b>Palynomorph group</b>	Non-arboreal pollen
<b>Growth form</b>	Herbaceous annual or biennial

**Characteristics**

<b>Pollen class</b>	Periporate, 7-10 pori
<b>Pollen grain shape</b>	Sphaeroid-globose to slightly prolate
<b>Pollen grain size</b>	29.0-38.0 µm
<b>Aperture</b>	Pori 1.5-2.0 µm, annulus 1.0-1.2 µm
<b>Sculpture</b>	Psilate
<b>Sporoderm</b>	Exine 0.7 µm

***Alisma* group****General remarks**

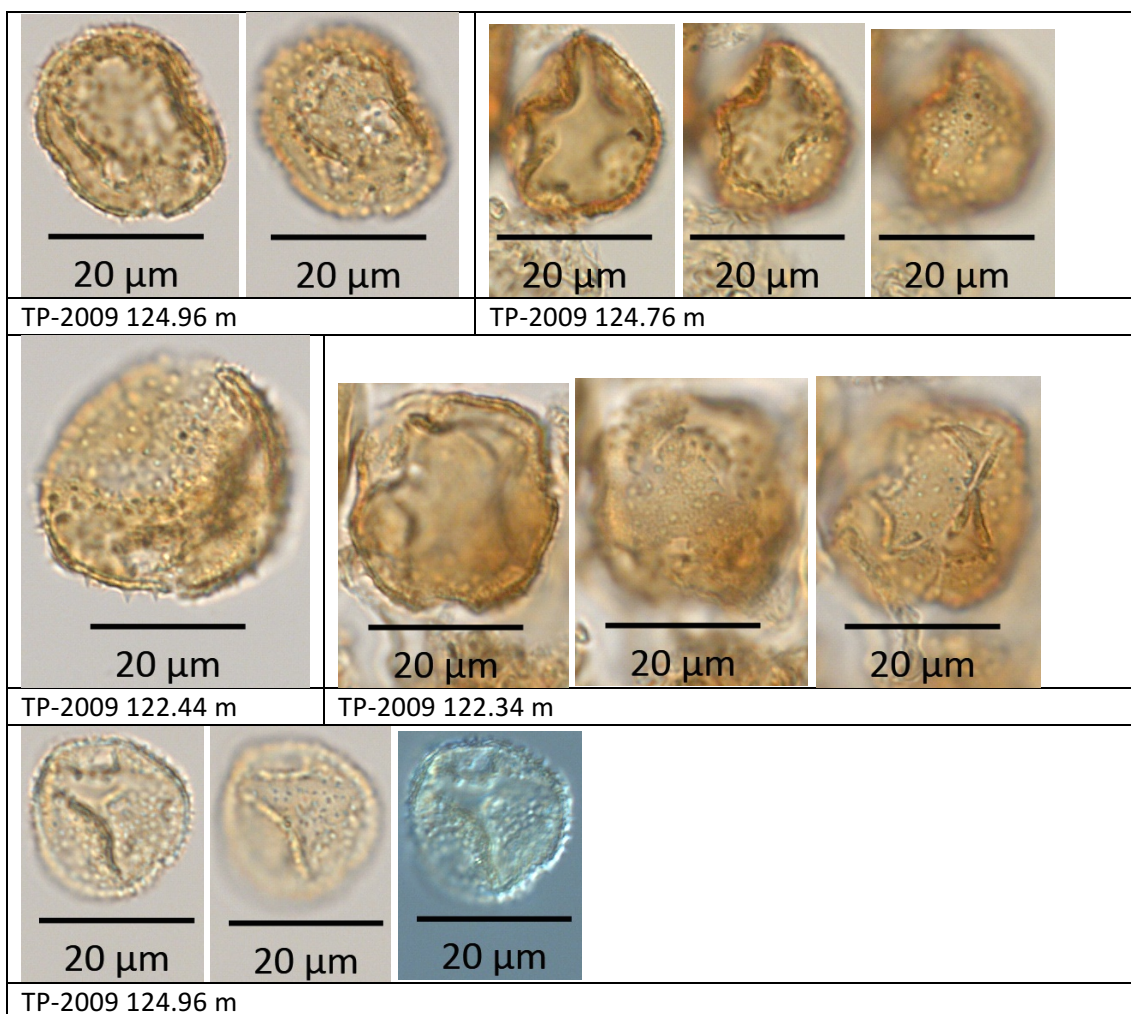
<b>Plant family</b>	Alismataceae
<b>Common names (English/German)</b>	Water-plantains Froschlöffel
<b>Palynomorph group</b>	<a href="#">Aquatic</a>
<b>Growth form</b>	Herbaceous perennials

**Characteristics**

<b>Pollen class</b>	Periporate, min. 15 pores
<b>Pollen grain shape</b>	Rounded-angular (7/8-angular)
<b>Pollen grain size</b>	21.5-37.0 µm
<b>Aperture</b>	Pori 3-6 µm
<b>Sculpture</b>	Psilate or slightly microechinate
<b>Sporoderm</b>	Exine 1.5-2.0 µm Columellae distinct, reticulate, brochi 1.5(-2.5) µm
<b>Ecology</b>	High abundances indicate water depth ca. <0.9 m (Harrison & Digerfeldt 1990)



*Sagittaria sagittifolia*



**General remarks**

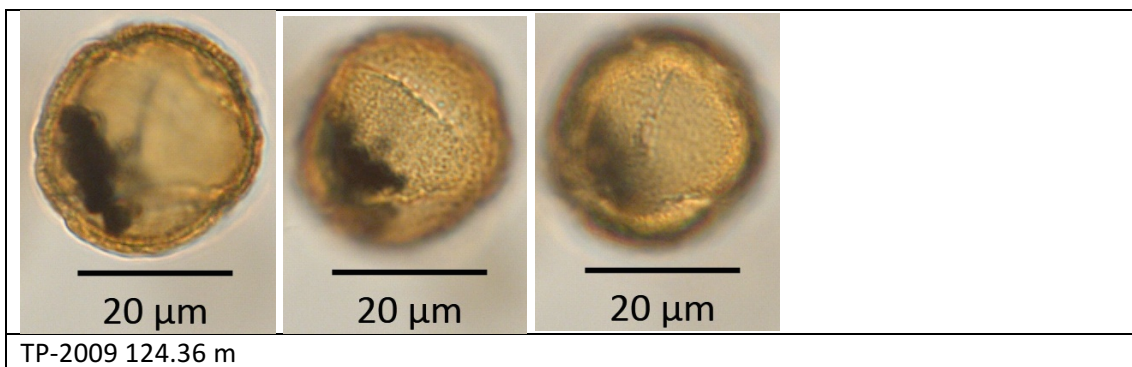
<b>Plant family</b>	Alismataceae
<b>Common names (English/German)</b>	Arrowhead Gewöhnliches Pfeilkraut
<b>Palynomorph group</b>	<a href="#">Aquatic</a>
<b>Growth form</b>	Herbaceous perennials

**Characteristics**

<b>Pollen class</b>	Periporate
<b>Pollen grain shape</b>	Sphaeroid-globose
<b>Pollen grain size</b>	26.5-30.5 µm
<b>Aperture</b>	Pori 3 µm, irregular, recessed, low-contrast, pore distance 10-12 µm
<b>Sculpture</b>	Echinate, echini max. 1.5 µm, element distance 2-3(-4) µm
<b>Sporoderm</b>	Exine 1.2-1.5 µm, tectate Columellae short, thin
<b>Ecology</b>	High abundances indicate water depth ca. <1.1 m (Harrison & Digerfeldt 1990)

# Pericolpatae

***Pulsatilla alpina***



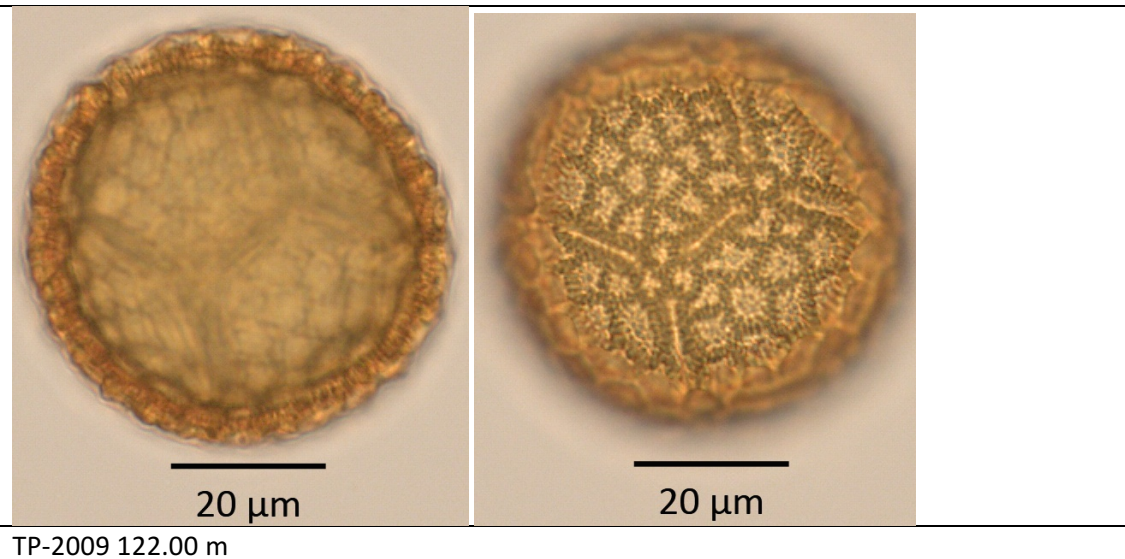
**General remarks**

<b>Plant family</b>	Ranunculaceae
<b>Common names (English/German)</b>	Alpine pasqueflower Alpen-Kuhschelle
<b>Palynomorph group</b>	Non-arboreal pollen
<b>Growth form</b>	Herbaceous perennials

**Characteristics**

<b>Pollen class</b>	Pericolpate ( $\pm$ syncolpate, stephanocolpate), 12 or 15 colpi
<b>Pollen grain shape</b>	Sphaeroid-globose to slightly prolate
<b>Pollen grain size</b>	27.5-35.0 µm
<b>Aperture</b>	Colpi regular or irregular, granulous
<b>Sculpture</b>	Scabrate to microechinate
<b>Sporoderm</b>	Exine 2.2-2.3 µm

***Persicaria amphibia* (= *Polygonum amphibium*)**



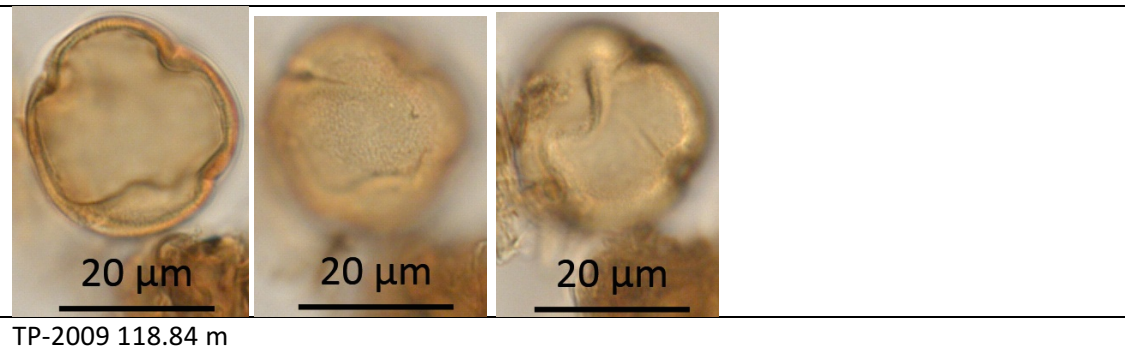
**General remarks**

<b>Plant family</b>	Polygonaceae
<b>Common names (English/German)</b>	Longroot smartweed, water knotweed, water smartweed, amphibious bistort Wasser-Knöterich
<b>Palynomorph group</b>	<a href="#">Aquatic</a>
<b>Growth form</b>	Herbaceous perennial

**Characteristics**

<b>Pollen class</b>	Pericolpate, 30 colpi
<b>Pollen grain shape</b>	Sphaeroid-globose
<b>Pollen grain size</b>	50.8-68.0 µm
<b>Aperture</b>	Colpi 8-11(-15) µm, thin, pentagondodekaed forming
<b>Sculpture</b>	Reticulate, brochi 6-11 µm, muri 1.0-1.5 µm
<b>Sporoderm</b>	Columellae 1 µm, duplicolumellate
<b>Ecology</b>	High abundances indicate water depth ca. <2.0 m (Harrison & Digerfeldt 1990)

# Pericolporatae

***Rumex aquaticus* type****General remarks**




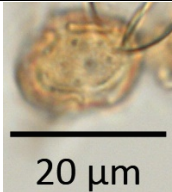
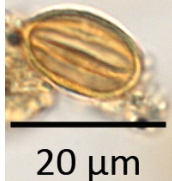
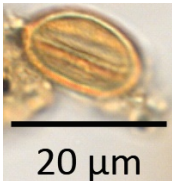
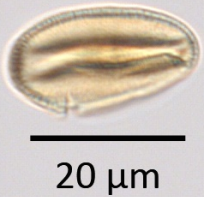
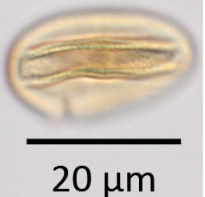

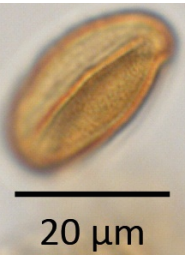




<b>Plant family</b>	Polygonaceae
<b>Common names (English/German)</b>	Western dock Wasser-Ampfer
<b>Palynomorph group</b>	<a href="#">Aquatic</a>
<b>Growth form</b>	Herbaceous perennials

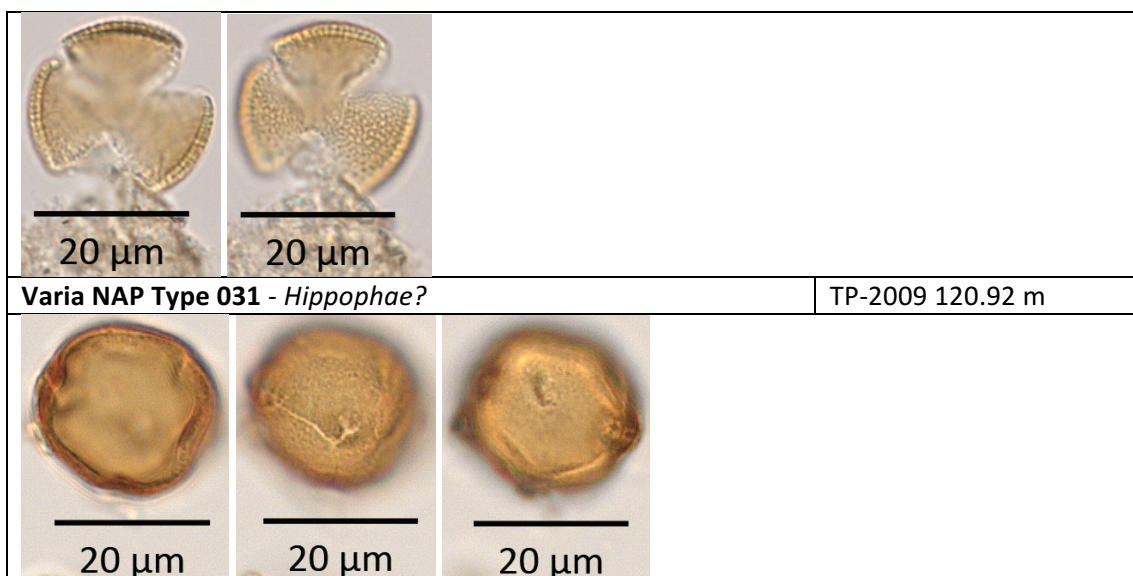
**Characteristics**

<b>Pollen class</b>	Pericolporate ( $\pm$ stephanocolporate/tetracolporate, colpi than tilted), 6 or 12 pori and colpi
<b>Pollen grain shape</b>	
<b>Pollen grain size</b>	30-50 µm
<b>Aperture</b>	Pori 3 µm
<b>Sculpture</b>	
<b>Sporoderm</b>	



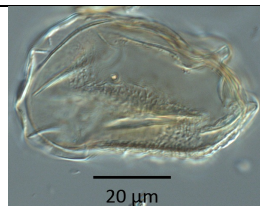
## Varia NAP

<b>Varia NAP Type 009</b>		TP-2009 122.60 m	
			
20 µm	20 µm		
<b>Varia NAP Type 015 - <i>Filipendula</i>?! </b>		TP-2009 121.97 m	
			
20 µm	20 µm		
<b>Varia NAP Type 019</b>			
TP-2009 123.76 m		TP-2009 124.48 m, <i>Saxifraga aizoides</i> group?	
			
20 µm	20 µm	20 µm	20 µm
TP-2009 124.72 m			
			
20 µm	20 µm		
<b>Varia NAP Type 022</b>		TP-2009 124.48 m	
			
20 µm	20 µm		
<b>Varia NAP Type 028</b>		TP-2009 126.04 m	
			
20 µm			
<b>Varia NAP Type 030</b>		TP-2009 125.96 m	



# **Monolete Spores**

## *Asplenium*



TP-2009 122.00 m

### General remarks

<b>Plant family</b>	Aspleniaceae
<b>Common names (English/German)</b>	Spleenworts Streifenfarne
<b>Palynomorph group</b>	<a href="#">Spores</a>
<b>Growth form</b>	Herbaceous perennials

### Characteristics

<b>Spore class</b>	Monolete
<b>Spore grain shape</b>	
<b>Spore grain size</b>	
<b>Aperture</b>	
<b>Sculpture</b>	
<b>Sporoderm</b>	

## *Cystopteris*

		
TP-2009 121.00 m		TP-2009 123.80 m

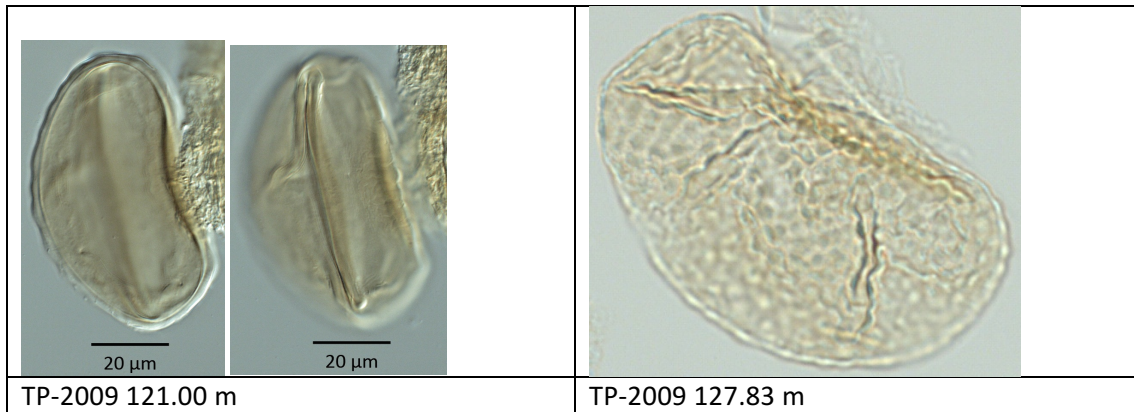
### General remarks

<b>Plant family</b>	Woodsiaceae
<b>Common names (English/German)</b>	Bladderfern Blasenfarn
<b>Palynomorph group</b>	<a href="#">Spores</a>
<b>Growth form</b>	Herbaceous perennials

### Characteristics

<b>Spore class</b>	Monolete
<b>Spore grain shape</b>	
<b>Spore grain size</b>	
<b>Aperture</b>	
<b>Sculpture</b>	
<b>Sporoderm</b>	

## Polypodiaceae



### General remarks

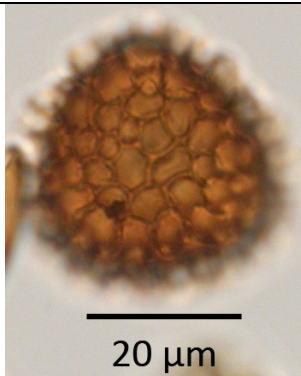
Plant family	Polypodiaceae
Common names (English/German)	Polypody, rockcap fern Tüpfelfarne
Palynomorph group	Spores
Growth form	Herbaceous perennials

### Characteristics

Spore class	Monolete
Spore grain shape	
Spore grain size	Ca. 65-92 µm
Aperture	
Sculpture	Psilate, echinate
Sporoderm	Exine ca. 0.8-2 µm, bizonate

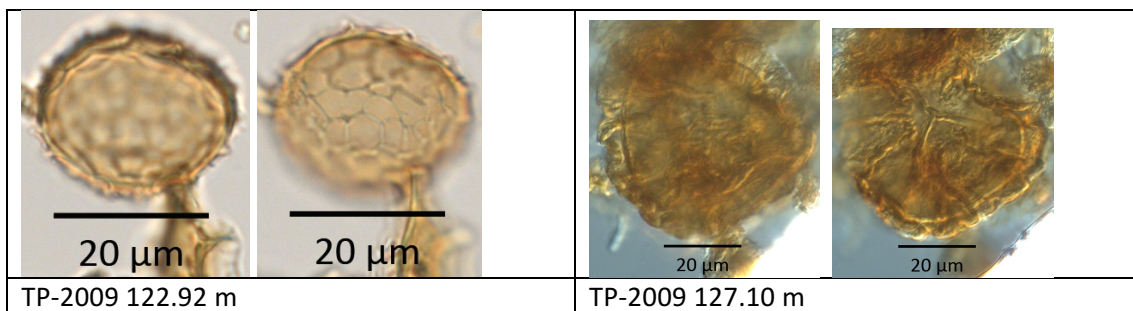


# Trilete Spores



*Lycopodium*, TP-2009 123.72 m; standard for pollen or charcoal concentration estimation (Stockmarr 1971)

## *Diphasium*



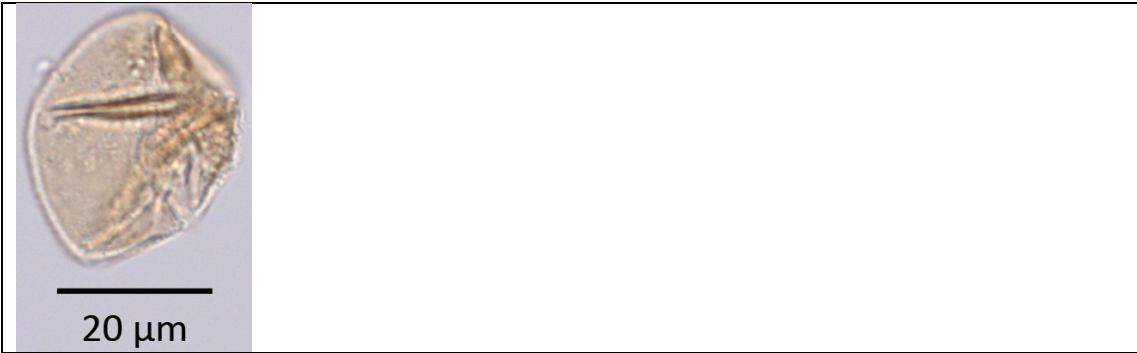
### General remarks

Plant family	Lycopodiaceae
Common names (English/German)	Clubmoss Flachbärlappe
Palynomorph group	Spores
Growth form	Herbaceous perennials

### Characteristics

Spore class	Trilete
Spore grain shape	
Spore grain size	
Aperture	
Sculpture	
Sporoderm	

*Selaginella*



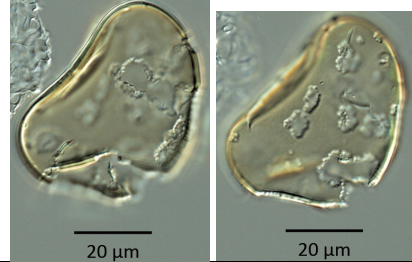
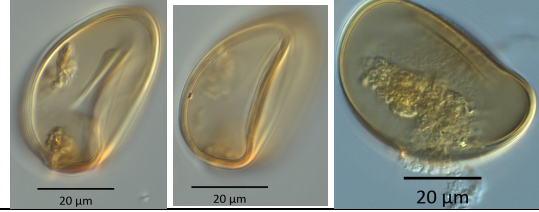
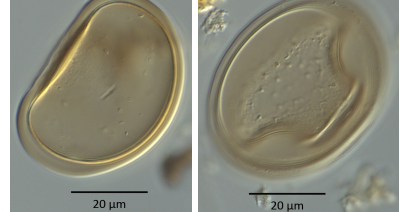
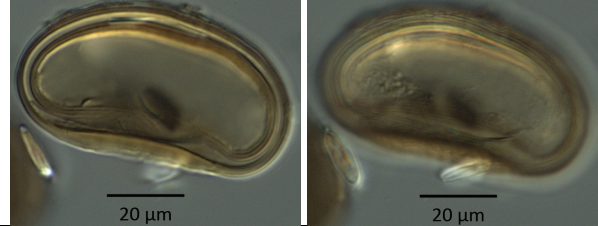
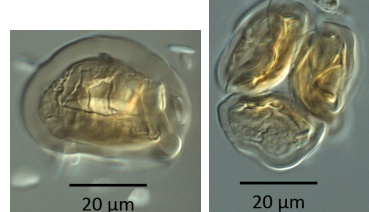
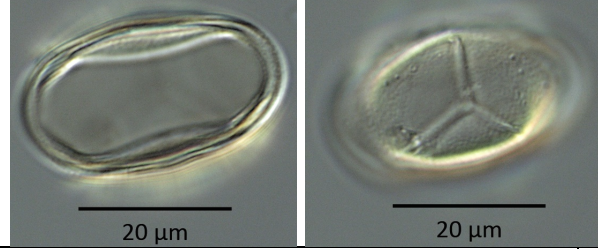
General remarks



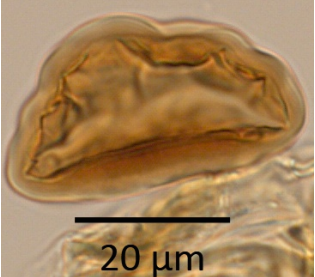
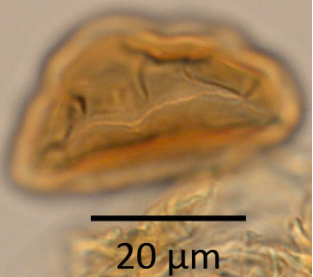
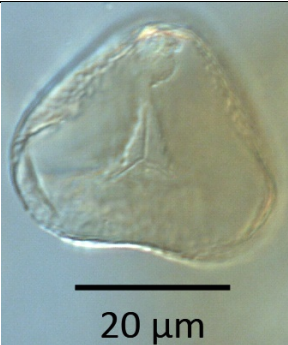

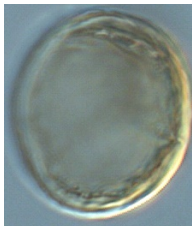
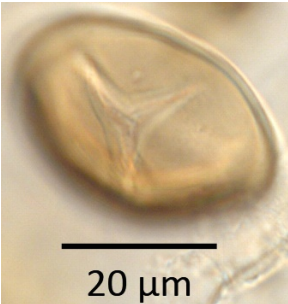

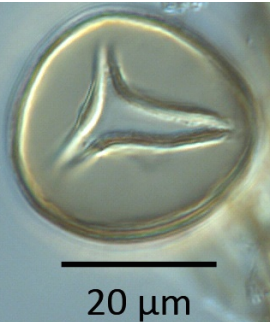
Plant family	Selaginellaceae
Common names (English/German)	Spikemosses, lesser clubmosses Moosfarne
Palynomorph group	<a href="#">Spores</a>
Growth form	Herbaceous perennials

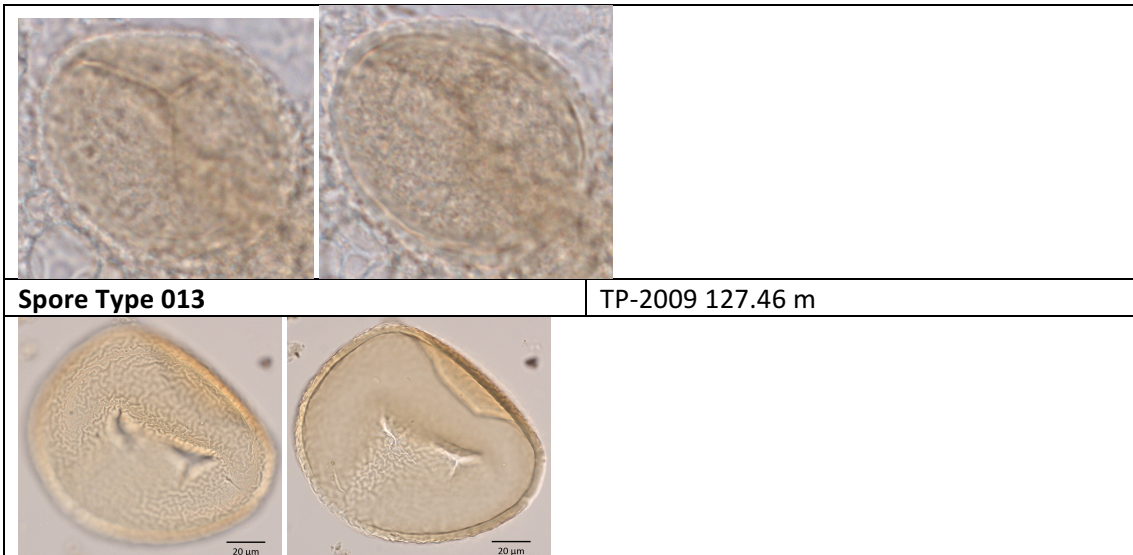
Characteristics

Spore class	Trilete
Spore grain shape	
Spore grain size	
Aperture	
Sculpture	
Sporoderm	

## Varia Spores

<b>Spore Type 001</b>	TP-2009 124.50 m
	
<b>Spore Type 002</b>	TP-2009 121.00 m; 122.08 m
	
<b>Spore Type 003</b>	TP-2009 121.00 m
	
<b>Spore Type 004</b>	TP-2009 121.00 m
	
<b>Spore Type 005</b>	TP-2009 121.00 m
	
<b>Spore Type 006</b>	TP-2009 124.50 m
	
<b>Spore Type 007 - Salviniaceae (<i>Salvinia</i>)?</b>	TP-2009 122.20m

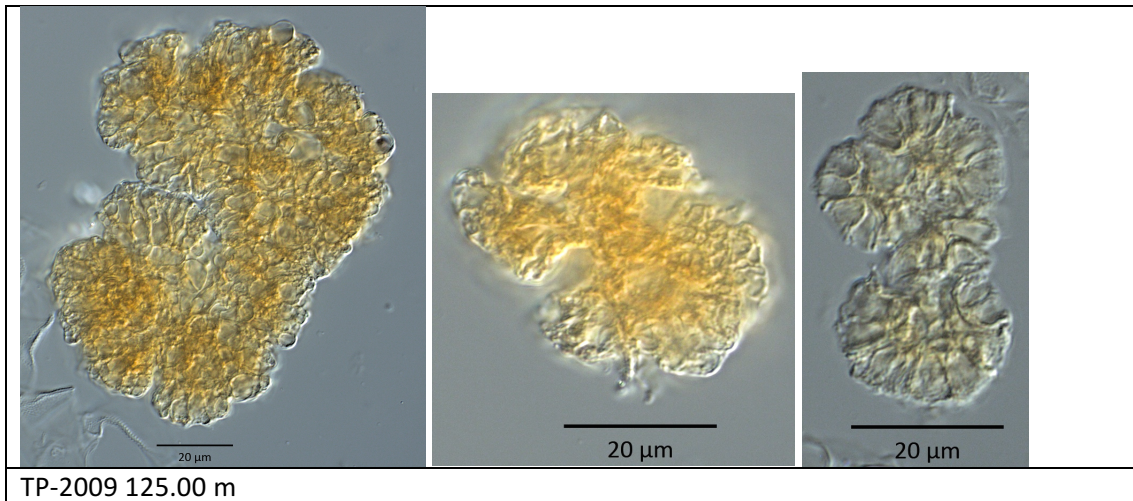
 		
<b>Spore Type 008</b>		TP-2009 122.42 m
 		
<b>Spore Type 009</b>		TP-2009 124.24 m
		
<b>Spore Type 010</b>		TP-2009 125.72 m
 		
<b>Spore Type 011</b>		
TP-2009 127.52 m		TP-2009 127.58 m
  		
<b>Spore Type 012</b>		TP-2009 127.38 m





# Algae

## *Botryococcus*



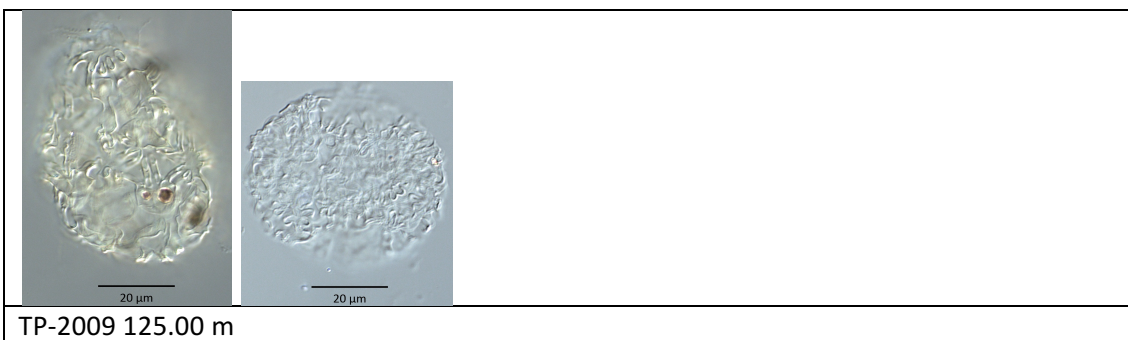
### General remarks

<b>Algaefamily</b>	Trebouxiophyceae
<b>Common names (English/German)</b>	
<b>Palynomorph group</b>	Algae
<b>Growth form</b>	Non-motile coenobiate green algae

### Characteristics

<b>Algae shape</b>	
<b>Ecology</b>	<p>Occurs in a wide spectrum of lakes from the tropics to subpolar regions, but is most common in shallow-water environments of semiarid to arid regions (Cohen 2003)</p> <p>Wide environmental tolerances but may be more characteristic of oligotrophic lakes, esp. those that are neutral or slightly alkaline (Guy-Ohlson 1992)</p> <p><i>Pediastrum</i> and <i>Botryococcus</i> abundances often vary inversely in cores, a situation that has been generally ascribed to differences in nutrient requirements (<i>Pediastrum</i> in general indicates nutrient-rich, relatively freshwater conditions) (Lamb et al. 1999)</p>
<b>Palaeoenvironmental facts</b>	<p>Sometimes form sedimented, gelatinous horizons that can be preserved as organic-rich layers in lake sediments (Cohen 2003)</p> <p>Oldest fossils from Late Proterozoic lake deposits (Guy-Ohlson 1992)</p>

## *Coelastrum*




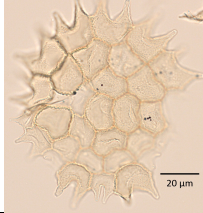
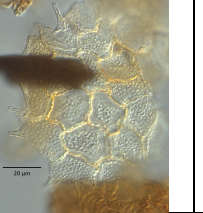
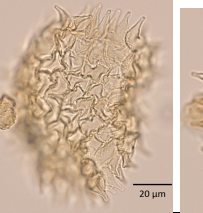
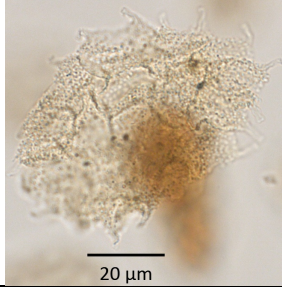
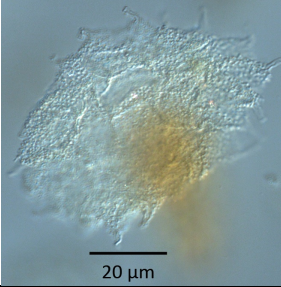
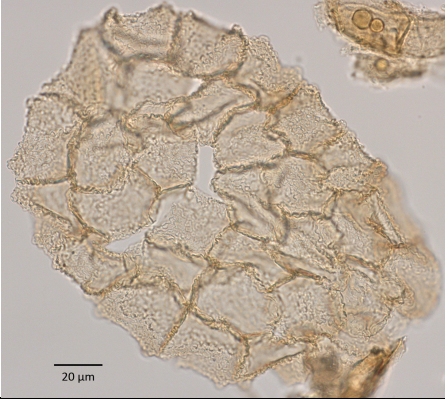
### General remarks

<b>Algaefamily</b>	Chlorophyceae
<b>Commone names (English/German)</b>	
<b>Palynomorph group</b>	Algae
<b>Growth form</b>	Non-motile coenobiate green algae

### Characteristics

<b>Colony shape</b>	Globose or rectangular
<b>Colony size</b>	120 µm
<b>Ecology</b>	Planktonic

### *Pseudopediastrum boryanum* type

			
TP-2009 123.72 m	TP-2009 122.00 m	TP-2009 121.00 m	TP-2009 121.41 m
			
TP-2009 124.64 m		TP-2009 125.60 m	

#### General remarks

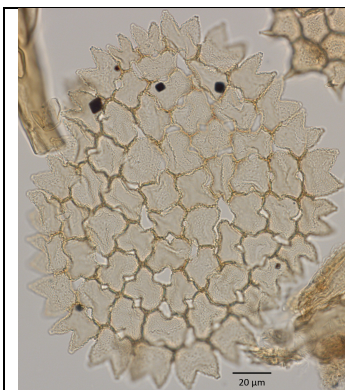
<b>Algae family</b>	Chlorophyceae
<b>Common names (English/German)</b>	
<b>Palynomorph group</b>	Algae
<b>Growth form</b>	Non-motile coenobiate green algae

#### Characteristics

<b>Coenobia shape</b>	± circular in outline, only large coenobia with irregular outline, with-out holes between cells, 4-64(-256) cells
<b>Coenobia size</b>	180(-250) µm
<b>Inner cell shape</b>	Arranged usually in concentric circles, only in many-celled coenobia ± irregular, outline irregular-polygonal
<b>Inner cell size</b>	4-39 x 4-35 µm
<b>Marginal cell shape</b>	With two lobes in a plane of coenobium, ending in narrow, ± long, cylindrical, hyaline processi, abrupt at the ends, v-shaped or u-shaped deep incision located between lobes at the cellular margin
<b>Marginal cell size</b>	4-39 x 4-35 µm
<b>Cell wall sculpture</b>	Regularly granular
<b>Ecology</b>	<b>Eutrophic</b> (but not polluted), usually slightly alkaline freshwaters in plankton and metaphyton of ponds, lakes, and swamps (Komárek & Jankovská 2001)
<b>Palaeoenvironmental facts</b>	<i>P. boryanum</i> var. <i>boryanum</i> and <i>P. duplex</i> var. <i>rugulosum</i> are the only <i>Pediastrum</i> members that occur in large numbers from Late Glacial until the present and are <b>adapted evidently to the increasing eutrophication of water biotopes</b> over the Earth (Komárek & Jankovská 2001)

	<b>Indication value insignificant for palaeoecological use, mesotrophic to eutrophic</b> (Komárek & Jankovská 2001)
<b>Distribution</b>	Cosmopolitan
<b>Remarks</b>	<i>P. boryanum</i> type includes <i>P. integrum</i> / <i>P. orientale</i> and <i>P. musteri</i>

***Pediastrum duplex*/*Pseudopediastrum boryanum* var. *cornutum* type**



TP-2009 121.69 m

**General remarks**

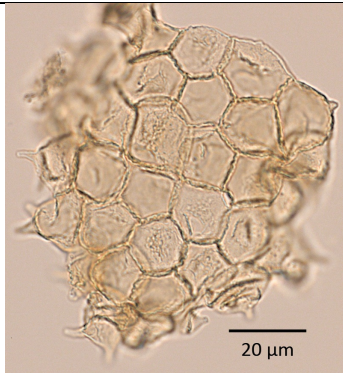
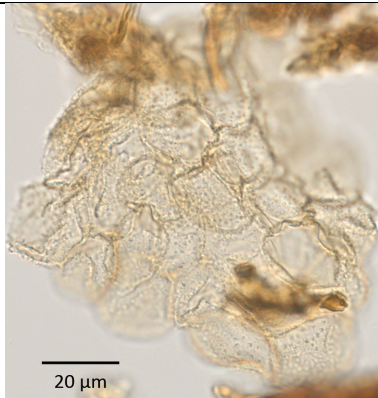
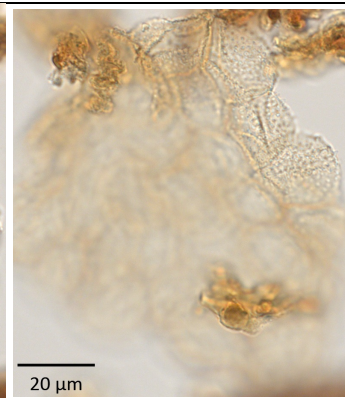
<b>Algae family</b>	Chlorophyceae
<b>Common names (English/German)</b>	
<b>Palynomorph group</b>	Algae
<b>Growth form</b>	Non-motile coenobiate green algae

**Characteristics**

<b>Coenobia shape</b>	± circular in outline, with regularly displaced holes between cells, diameter of holes smaller than cell diameter, 8-64(-128) cells
<b>Coenobia size</b>	Max. 212 µm
<b>Inner cell shape</b>	Arranged concentrically (± spirally, irregularly), quadratic in outline, concave sides, joined together only by their corners
<b>Inner cell size</b>	4-30 µm
<b>Marginal cell shape</b>	V-like incisions, two long conical lobes are situated in the plane of coenobium and narrowed to their ends
<b>Marginal cell size</b>	6-28 µm
<b>Cell wall sculpture</b>	Smooth to coarsely waved with irregular net-like sculpture
<b>Ecology</b>	Freshwater plankton; less metaphytic, with naturally increasing trophic level, <b>probably not very ecologically delimited</b> (Komárek & Jankovská 2001)
<b>Palaeoenvironmental facts</b>	<i>P. boryanum</i> var. <i>boryanum</i> and <i>P. duplex</i> var. <i>rugulosum</i> are the only <i>Pediastrum</i> members that occur in large numbers from Late Glacial until the present and are adapted evidently to the increasing eutrophication of water biotopes over the Earth (Komárek & Jankovská 2001) <i>P. duplex</i> : indicator of <b>large lakes</b> from Holocene to present (Komárek & Jankovská 2001) <i>P. boryanum</i> var. <i>cornutum</i> : prefers <b>pelagial of large water bodies</b> , not overgrown by water plants and <b>naturally eutrophic</b> (Komárek & Jankovská 2001)
<b>Distribution</b>	In temperate zone (Komárek & Jankovská 2001)



### *Pediastrum integrum/orientale* type

	 
cold water type, TP-2009 121.41 m	warm water type, TP-2009 123.32 m

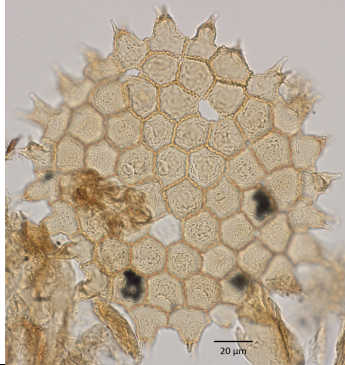
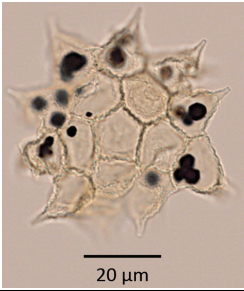
#### General remarks

<b>Algae family</b>	Chlorophyceae
<b>Common names (English/German)</b>	
<b>Palynomorph group</b>	Algae
<b>Growth form</b>	Non-motile coenobiate green algae

#### Characteristics

<b>Coenobia shape</b>	
<b>Coenobia size</b>	
<b>Inner cell shape</b>	
<b>Inner cell size</b>	
<b>Marginal cell shape</b>	
<b>Marginal cell size</b>	
<b>Cell wall sculpture</b>	
<b>Ecology</b>	<p><i>P. integrum</i> is common in lake sediments indicates <b>oligotrophic and dystrophic cold and clear large and small lakes and peaty basins</b></p> <p><i>P. orientale</i> prefers clear and <b>probably cool waters</b> (Komárek &amp; Jankovská 2001)</p>
<b>Palaeoenvironmental facts</b>	<p><i>P. integrum</i> is an accompanying species of the mass occurrence of <i>P. kawraiskyi</i> in oligotrophic lakes (Komárek &amp; Jankovská 2001)</p>
<b>Distribution</b>	<p><i>P. integrum</i>'s sporadic occurrence in central Europe may indicate the vegetation and climatic conditions corresponding to the zone of forest tundra and tundra at that time (Komárek &amp; Jankovská 2001)</p>

***Pseudopediastrum kawraiskyi* type**

	
TP-2009 121.29 m	TP-2009 121.21 m

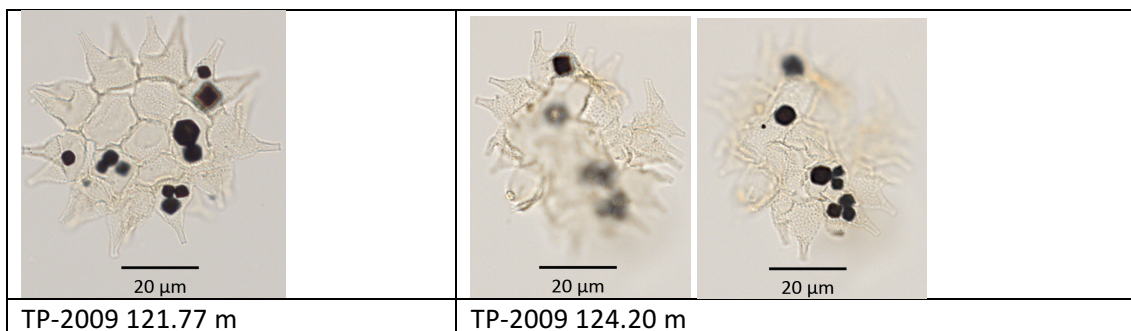
**General remarks**

<b>Algae family</b>	Chlorophyceae
<b>Common names (English/German)</b>	
<b>Palynomorph group</b>	Algae
<b>Growth form</b>	Non-motile coenobiate green algae

**Characteristics**

<b>Coenobia shape</b>	± circular in outline (± irregular), without holes between cells, 4-32 cells
<b>Coenobia size</b>	Max. 100 µm
<b>Inner cell shape</b>	Arranged concentrically, completely joined with their sides, cells irregularly polygonal in the coenobial center, ± straight sides
<b>Inner cell size</b>	4.6-15.2 x 6.6-17.9 µm
<b>Marginal cell shape</b>	Elongated into one wide, massive lobe, which divides approximately in its half length into two conical secondary lobes, which are oriented perpendicular to the plane of coenobium; secondary lobes terminated by short but distinct, narrow, cylindrical processes, abrupt at the ends
<b>Marginal cell size</b>	15-21 x 11-16 µm
<b>Cell wall sculpture</b>	Warty, irregularly (± indistinctly granular)
<b>Ecology</b>	Freshwater plankton; clear, cold stenotherm water bodies; mainly in slightly eutrophicated (± oligotrophic or mesotrophic) lakes of colder areas of temperate zones; connected with peaty areas (Nielsen & Sørensen 1992, Komárek & Jankovská 2001)
<b>Palaeoenvironmental facts</b>	Common part of the algal flora of the lakes with cool and clear water in the Pleistocene, early Holocene and Late Glacial; in past indicator for <b>oligotrophic lakes</b> and ponds with water plants and <b>cold and clear water</b> (Komárek & Jankovská 2001)
<b>Distribution</b>	Boreo-alpine, latitudes >40°, high mountains (Komárek & Jankovská 2001)

## *Pediastrum musteri*



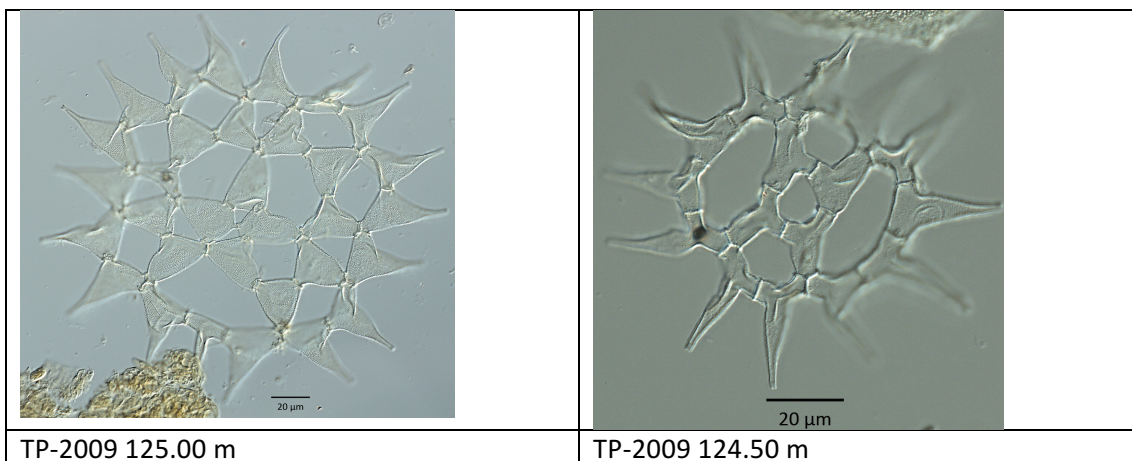
### General remarks

<b>Algae family</b>	Chlorophyceae
<b>Common names (English/German)</b>	
<b>Palynomorph group</b>	Algae
<b>Growth form</b>	Non-motile coenobiate green algae

### Characteristics

<b>Coenobia shape</b>	Circular in outline, flat or slightly campanulate, with regular holes, 8-16-32 cells
<b>Coenobia size</b>	31-99 µm
<b>Inner cell shape</b>	Arranged concentrically, rarely with small irregularities in position of central cells, in middle of coenobium rectangular, in outline with concave sides, joined with their corners
<b>Inner cell size</b>	5.2-16.5 x 3.9-12.6 µm
<b>Marginal cell shape</b>	With two lobes, elongated into narrow processi, situated perpendicular to the plane of coenobium, cells concave at the side oriented to the center of the coenobium
<b>Marginal cell size</b>	6.6-19.8 x 6.6-15.9 µm
<b>Cell wall sculpture</b>	Regular hexagonal net-like and warty sculpture
<b>Ecology</b>	Rare species, occurs sporadically in large and clear lakes (Komárek & Jankovská 2001)
<b>Palaeoenvironmental facts</b>	Artifact? (Bottema 1979)
<b>Distribution</b>	Arid regions and temperate zones of both hemispheres (Komárek & Jankovská 2001)

## *Monactinus simplex*



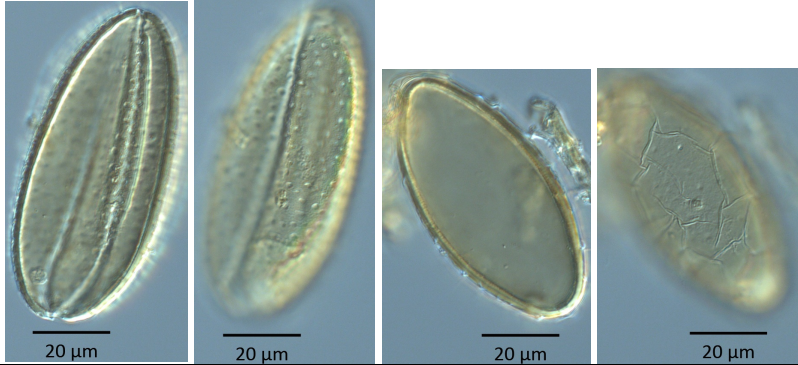

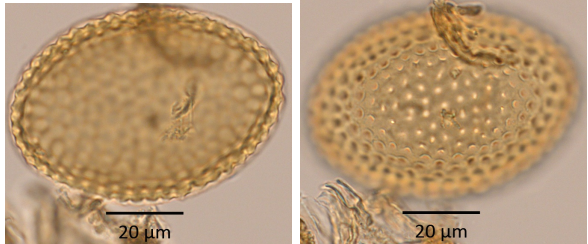
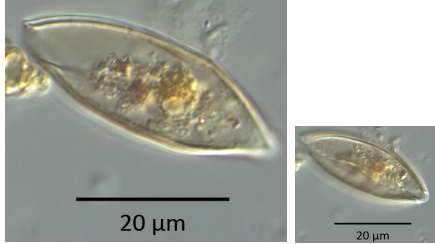
### General remarks

<b>Algae family</b>	Chlorophyceae
<b>Common names (English/German)</b>	
<b>Palynomorph group</b>	Algae
<b>Growth form</b>	Non-motile coenobiate green algae

### Characteristics

<b>Coenobia shape</b>	± circular in outline, with or without holes, 4-32(-128) cells
<b>Coenobia size</b>	Max. 246 µm
<b>Inner cell shape</b>	Arranged in concentric circles (± spirally or one circle with one large central opening)
<b>Inner cell size</b>	6-40 x 6-36 µm
<b>Marginal cell shape</b>	One conically narrowed lobe situated in the middle of the outer margin; terminating with long, narrow, cylindrical processus
<b>Marginal cell size</b>	(12-)16-57 x 6-38 µm
<b>Cell wall sculpture</b>	Granular; near the cell-walls connecting with neighbouring cells occur short, solitary, chimney-like rosettes (Komárek & Jankovská 2001)
<b>Ecology</b>	Freshwater plankton, eutrophic (now mainly mesotrophic), neutral to alkaline water, meioeuryhaline, oligohalobe, thermophilous (Komárek & Jankovská 2001)
<b>Palaeoenvironmental facts</b>	Indicator for favourable warm climate (depending above all on summer temperature), <b>indicator for warm and eutrophic conditions</b> (Komárek & Jankovská 2001)
<b>Distribution</b>	Cosmopolitan, lacking in cold regions of temperate zone and circum-polar areas, common particularly in tropical lakes and during warm seasons in temperate zones (Komárek & Jankovská 2001)

## *Spirogyra*

				
TP-2009 122.16 m				TP-2009 124.50 m
				
TP-2009 122.20 m		TP-2009 126.00 m		

### General remarks

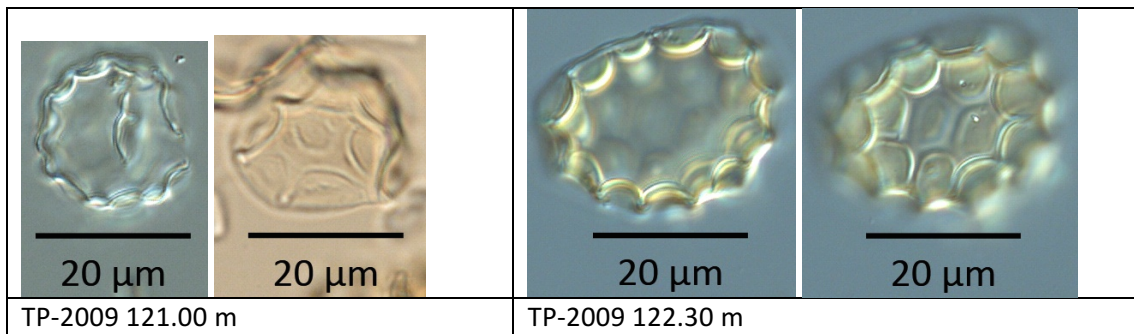
<b>Algae family</b>	Zygnemataceae
<b>Common names (English/German)</b>	Schraubenalge
<b>Palynomorph group</b>	Algae
<b>Growth form</b>	Filamentous green algae

### Characteristics

<b>Algae shape</b>	Helical or spiral
<b>Algae size</b>	10-100 µm broad, centimeters long
<b>Cell wall sculpture</b>	Psilate
<b>Ecology</b>	Freshwater benthos, open and shallow water, mesotrophic to eutrophic (van Geel 1978, van Geel & van der Hammen 1978)



## Zygnemataceae Type 58/66/74 van Geel 1978



### General remarks

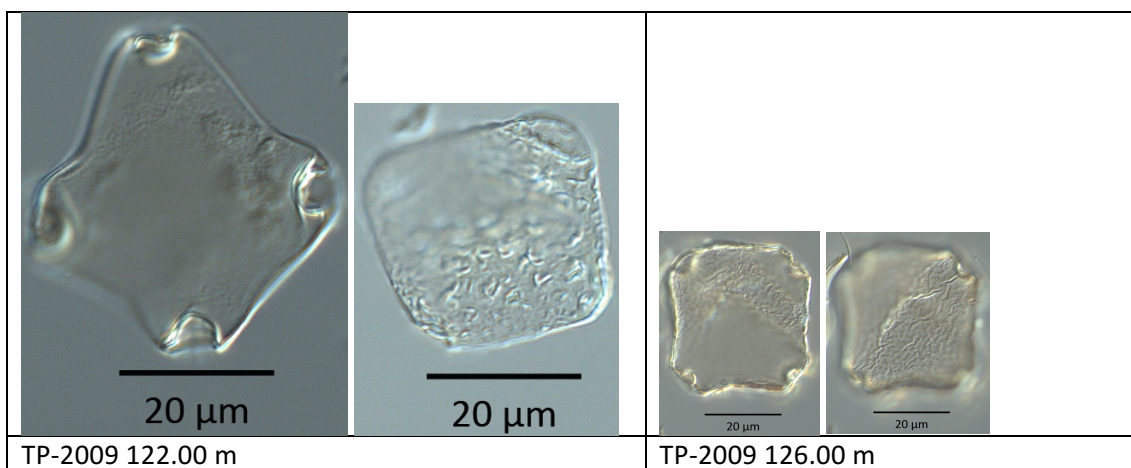
<b>Algae family</b>	Zygnemataceae
<b>Common names (English/German)</b>	Jochalge
<b>Palynomorph group</b>	Algae
<b>Growth form</b>	Zygospores or aplanospores of green algae

### Characteristics

<b>Algae shape</b>	Sphaeroid-globose
<b>Algae size</b>	20.0-25.0 µm
<b>Cell wall sculpture</b>	Psilate-reticulate
<b>Ecology</b>	Freshwater benthos, open and shallow water, spores produced during spring in stagnant, shallow and mesotrophic to eutrophic fresh waters (less than 0.5 m deep) which warm up quickly (van Geel 1978, van Geel & van der Hammen 1978)



***Mougeotia cf. gracillima* Type 61 van Geel 1978**



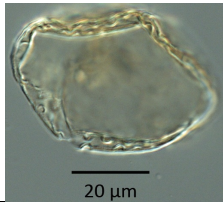
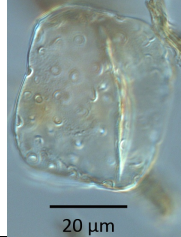
**General remarks**

<b>Algae family</b>	Zygnemataceae
<b>Common names (English/German)</b>	Jochalge
<b>Palynomorph group</b>	Algae
<b>Growth form</b>	Zygospores of green algae

**Characteristics**

<b>Algae shape</b>	Square, laterally straight to concave
<b>Algae size</b>	22-28 x 25-30 µm
<b>Cell wall sculpture</b>	Psilate, circular depressions in centre of angles 2-3 µm deep and 3-3.5 µm in diameter, small slit-shaped pits all over surface, 0.5 µm, pit distance 2 µm
<b>Ecology</b>	Freshwater benthos, open and shallow water, spores produced during spring in open water; preferring mesotrophic, but more oligotrophic conditions (van Geel 1978, van Geel & van der Hammen 1978)

## Zygnemataceae Type 62 van Geel 1978

	
TP-2009 121.00 m	TP-2009 123.20 m

### General remarks

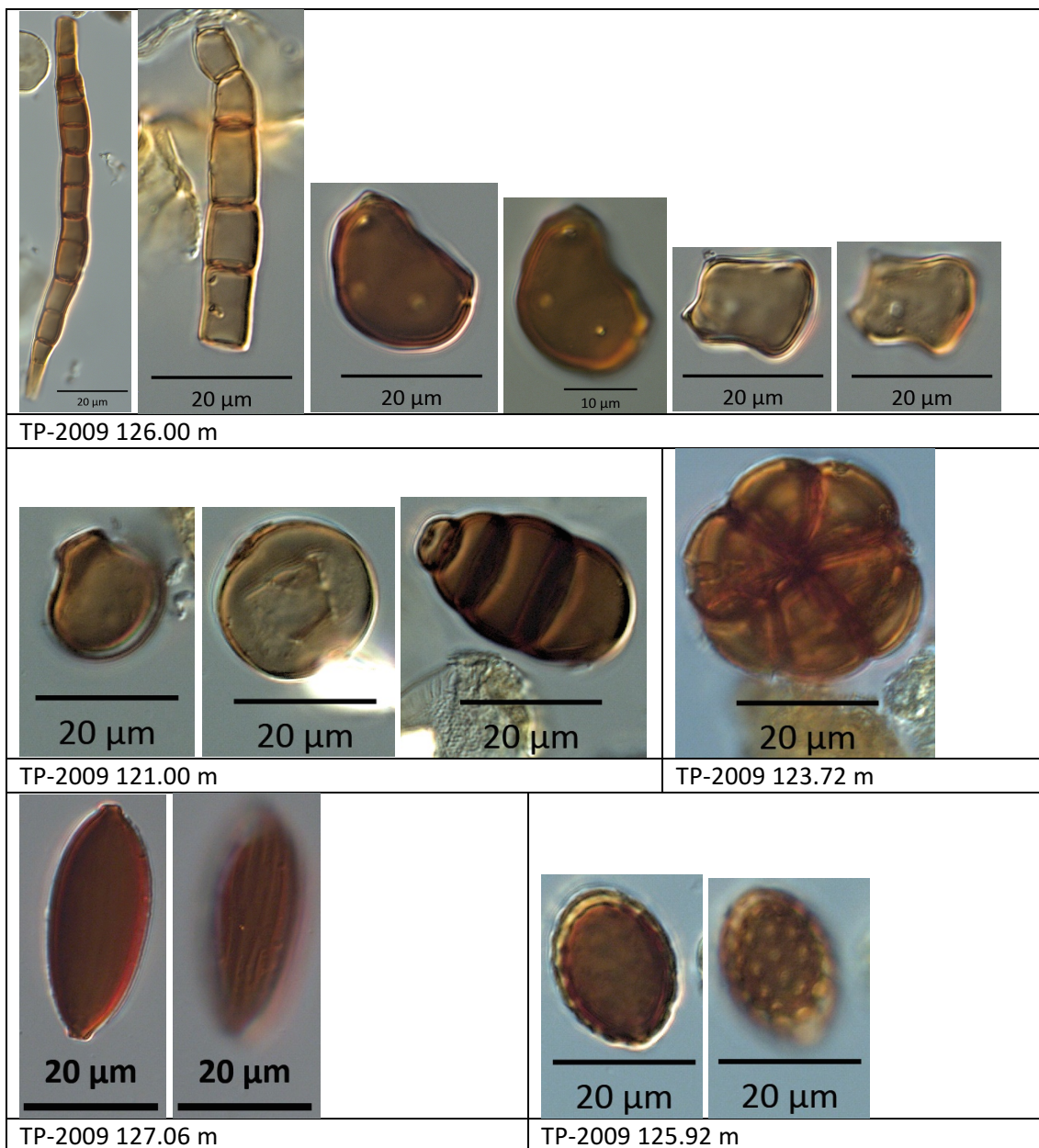
<b>Algae family</b>	Zygnemataceae
<b>Common names (English/German)</b>	Jochalge
<b>Palynomorph group</b>	Algae
<b>Growth form</b>	Zygospores or aplanospores of green algae

### Characteristics

<b>Algae shape</b>	Sphaeroid-globose, flattened, often folded
<b>Algae size</b>	50.0 x 45.0 µm
<b>Cell wall sculpture</b>	Psilate, circular dents 2 µm deep and 2 µm in diameter, dent distance 2-8 µm
<b>Ecology</b>	Freshwater benthos, open and shallow water, spores produced during spring in stagnant, shallow and mesotrophic open waters (van Geel 1978, van Geel & van der Hammen 1978)

# Fungi

## Ascospore



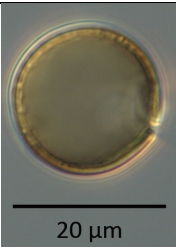

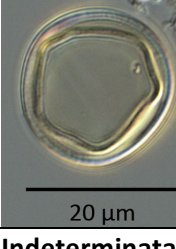
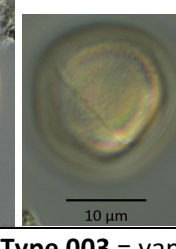
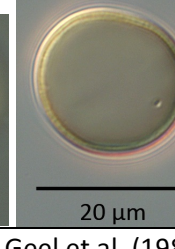
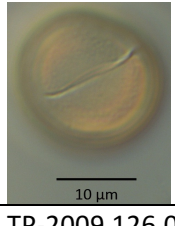
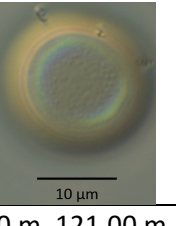
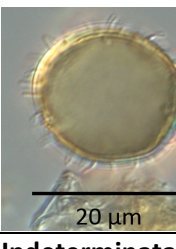
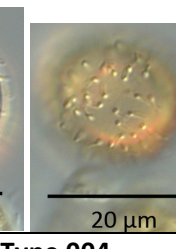
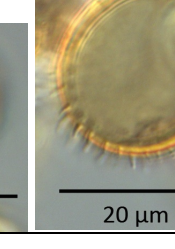
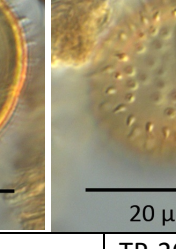
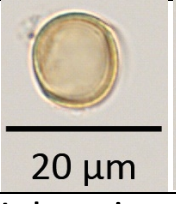
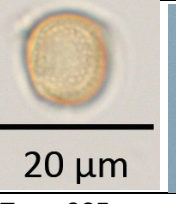
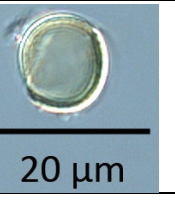
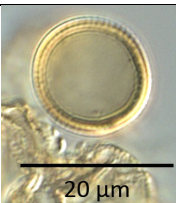



### General remarks

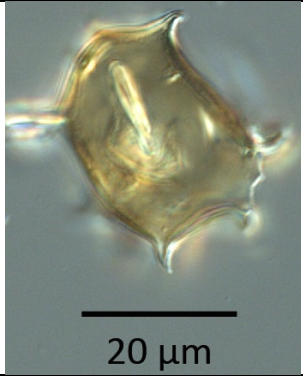
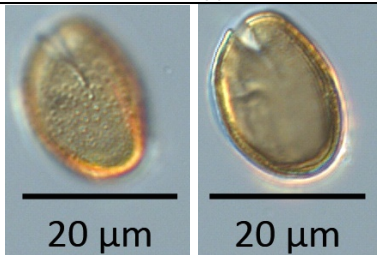
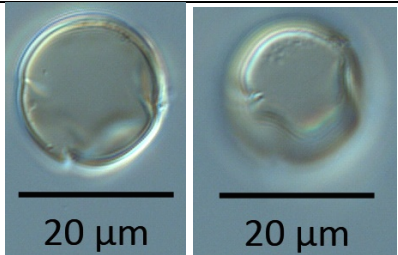

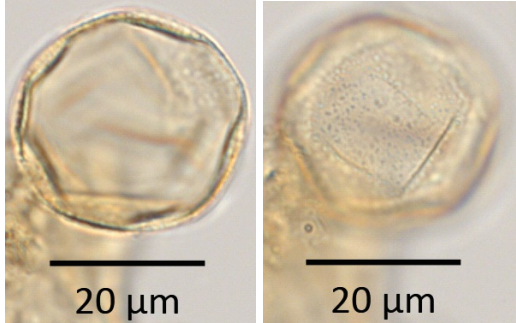
<b>Fungi phylum</b>	Ascomycota
<b>Common names (English/German)</b>	Sac fungi Schlauchpilze
<b>Palynomorph group</b>	Fungi
<b>Growth form</b>	Spore contained or produced in an ascus

### Characteristics

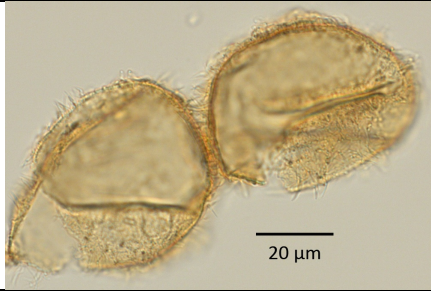
<b>Spore shape</b>	Irregular with pores, chain-shaped strung together
<b>Ecology</b>	growing in decaying wood and indicative of soil erosion (Revelles & van Geel 2016)

## Non-pollen indeterminate

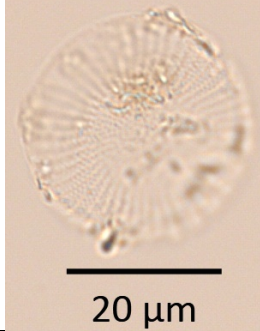
<b>Indeterminata Type 001</b>		TP-2009 126.00 m
 		
<b>Indeterminata Type 002</b>		
TP-2009 126.00 m		TP-2009 121.00 m
  		 
<b>Indeterminata Type 003 = van Geel et al. (1983) Type 181?</b>		TP-2009 126.00 m, 121.00 m
   		
<b>Indeterminata Type 004</b>		TP-2009 124.60 m
  		
<b>Indeterminata Type 005</b>		TP-2009 126.00 m
 		
<b>Indeterminata Type 006</b>		TP-2009 124.50 m
 		
<b>Indeterminata Type 007 - supporting cell of water plants?</b>		TP-2009 121.00 m

		
<b>Indeterminata Type 008</b>		TP-2009 122.42 m
		
<b>Indeterminata Type 009</b>		TP-2009 122.80 m
		
<b>Indeterminata Type 010 - bulbils?</b>		TP-2009 122.84 m
		
<b>Indeterminata Type 011</b>		TP-2009 121.04 m
		
<b>Indeterminata Type 012</b>		TP-2009 121.04 m

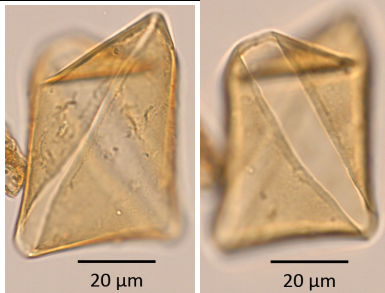


**Indeterminata Type 013** - diatom

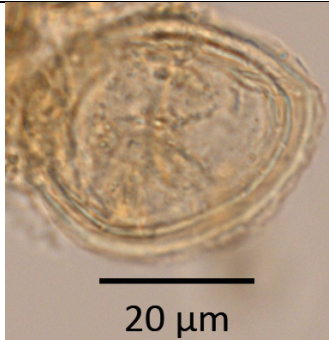
TP-2009 122.00 m

**Indeterminata Type 014** - Scenedsmaceae, *Crucigenia*

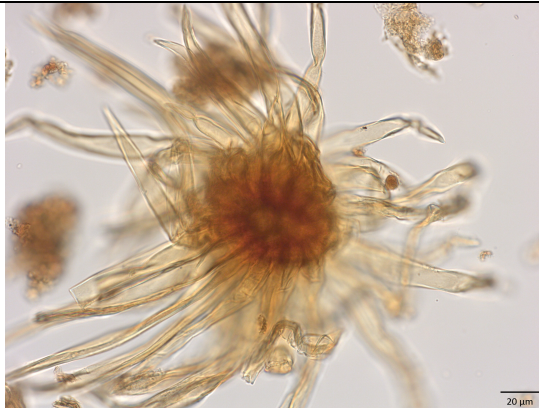
TP-2009 121.00 m

**Indeterminata Type 015** - *Nymphaea* basal cell

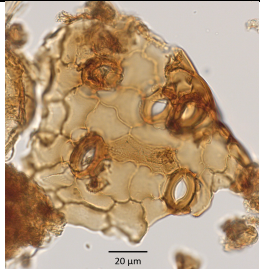
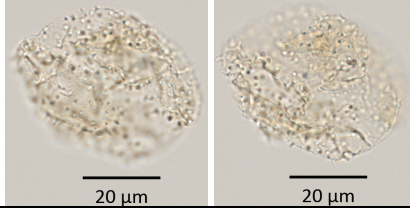
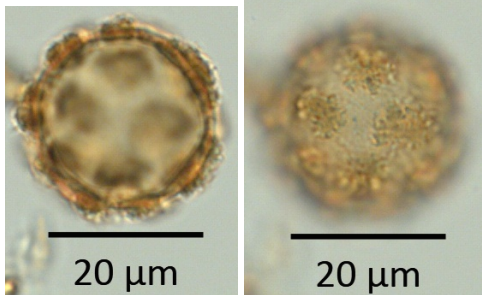
TP-2009 122.42 m

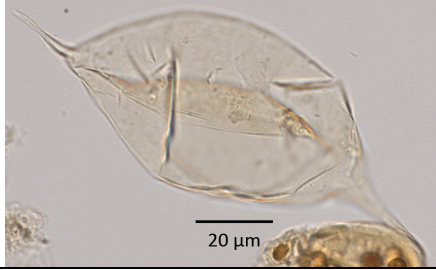

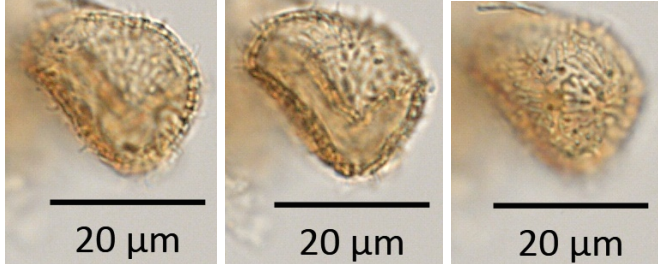
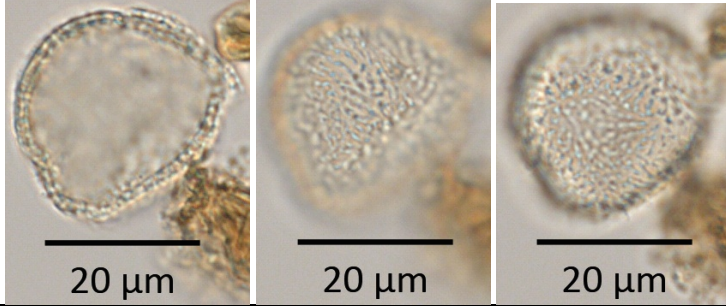
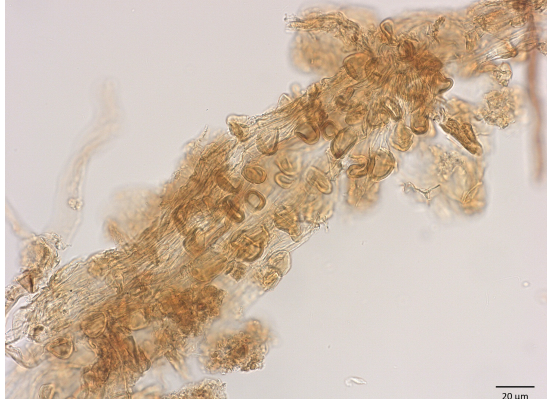
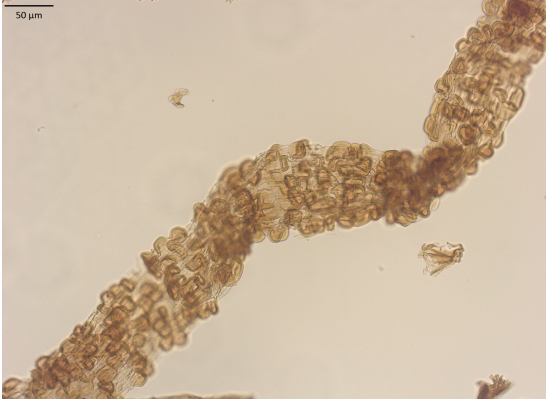
**Indeterminata Type 016**

TP-2009 123.68 m

**Indeterminata Type 017** - stomata

TP-2009 122.92 m

	
<b>Indeterminata Type 018</b>	TP-2009 123.12 m
	
<b>Indeterminata Type 019</b>	TP-2009 124.20 m
	
<b>Indeterminata Type 020 - insect remain</b>	TP-2009 125.92 m
	
<b>Indeterminata Type 021</b>	TP-2009 127.02 m
	
<b>Indeterminata Type 022</b>	TP-2009 126.40 m
	
<b>Indeterminata Type 023 - egg</b>	TP-2009 127.67 m

	
<b>Indeterminata Type 024</b>	TP-2009 127.83 m
	
<b>Indeterminata Type 025 - <i>Asplenium lepidum</i>?</b>	
TP-2009 123.44 m	
	
TP-2009 125.28 m	
	
<b>Indeterminata Type 026 - Cyperaceae root</b>	
TP-2009 120.20 m	TP-2009 120.08 m
	

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